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The American Journal of Surgery

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EDITORIAL

Confusion in the Treatment of Carcinoma of the Breast

HAS the medical profession ceased to regard the problem of carcinoma of the breast as seriously as it once did? I think there has been a decided change in attitude toward the implications and treatment of this disease on the part of some general practitioners and surgeons.

It is easy to see why we have become somewhat unsure of the treatment of choice: we have become confused by the conflicting comments concerning the relative merits of simple mastectomy combined with radiation therapy, supraradical mastectomy and the standard radical mastectomy as taught by Dr. Halsted.

More and more often we are seeing patients referred to our Surgical Clinic and Consultative Tumor Board in whom it is quite obvious that the original treatment was inadequate and incomplete. I am certain that the lives of many of these patients are being sacrificed because of inadequate initial treatment. Even if one is convinced that the McWhirter procedure is the operation of choice (and I am not), I am certain that most of these patients would not get an amount of radiation therapy in this country which would be comparable to that given in McWhirter's clinic in Edinburgh.

Just recently a forty-four year old woman was referred to our Consultative Tumor Board for recommendations concerning further treatment. She had been operated upon in a small community for fibroids of the uterus. A small lump in the midline over the sternum had been discovered during the performance of an hysterectomy; this was removed and sent to the laboratory. It was reported one week later that this small lump was carcinoma, origin unknown.

When we saw the patient it was quite clear to us that this mass had been removed from the medial edge of the left breast. Evidently the physician had not realized the extent of the breast tissue. We have seen many patients in our Clinic upon whom a supposedly complete simple mastectomy had been performed, yet we often found that breast tissue still remained on the chest wall on the side that had been operated upon.

We also have had many patients referred to our Clinic for consultation concerning the administration of hormonal therapy after "radical mastectomy." Frequently, however, these women had not undergone radical mastectomy as we understand it. Moreover, hormones *per se* have no place in the primary definitive treatment of operable carcinoma of the breast.

As Dunphy [1] stated in the March, 1958 issue of *Surgery, Gynecology and Obstetrics*, "It is reprehensible for the occasional operator who would not undertake a radical mastectomy to perform a simple mastectomy and then refer the patient to a larger center for radiation therapy. A properly performed simple mastectomy, although perhaps easier on the patient, requires as much skill and care on

[1] DUNPHY, J. E., The cancer controversy. *Surg., Gynec. & Obst.*, 106: 353–354, 1958.

the part of the surgeon as a radical mastectomy." I agree completely with Dr. Dunphy's statement.

The biological potential of given tumors and the host resistance to them is being discussed a great deal today, but I am sure that many of us do not quite know what all this means. We have seen patients who have been well for twenty-seven years after radical mastectomy get a recurrence of the tumor directly in the scar. We also have occasionally seen patients who have had only a quadrant excision of the carcinomatous tissue, yet they are still alive and well many years later without recurrence.

These cases are extremely rare, however, and do not justify cutting corners in the treatment of this disease. If it has been established that the treatment of choice for a particular patient is radical mastectomy, with or without postoperative radiation therapy, then this radical operation must be performed, and it must be performed completely.

I do not think it is inappropriate here to remind the medical profession that carcinoma of the breast, although a very serious disease, is often curable if recognized early and submitted to adequate primary surgical treatment.

H. Glenn Bell, M.D.,
Department of Surgery,
University of California School of Medicine,
San Francisco, California

SCIENTIFIC PAPERS

Current Problems in the Surgical Treatment of the Biliary Tract

FRANK GLENN, M.D., *New York, New York*

From the Department of Surgery, The New York Hospital-Cornell Medical Center, New York, New York.

WITH the introduction of cholecystography by Graham, Cole and Copher in 1924 the diagnosis and treatment of biliary tract disease were greatly advanced. In the intervening thirty-four years it appears that the incidence of gallstones in our population has increased so that at present it is estimated that over 10 per cent of adults have calcareous biliary tract disease. The surgical treatment for this condition has been so successful that it has come to be recognized as the therapy of choice. Consequently the frequency with which operations upon the biliary tract are being undertaken places such procedures among those most frequently performed by surgeons throughout the United States. The current problems in the surgical treatment of biliary tract disease are therefore of specific interest to physician and surgeon alike because so many patients of both are involved. It is my purpose to discuss briefly and in summary fashion some of these problems that are representative of changing trends, and to suggest a classification of the stages of biliary tract disease as encountered at operation. These are as follows: (1) conditions that exist concomitantly with cholecystitis and cholelithiasis; (2) common duct stone and intravenous cholangiography; (3) biliary enteric fistulas and gallstone ileus; (4) biliary tract operations in patients sixty-five years of age and over; (5) technics of operation and immediate postoperative complications; and (6) a classification of biliary tract disease.

CONDITIONS THAT EXIST CONCOMITANTLY WITH CHOLECYSTITIS AND CHOLELITHIASIS

The following conditions may be the cause of the presenting symptoms: (1) peptic ulcer, (2) recurrent pancreatitis [*1-3*], (3) lesions of the right kidney, (4) coronary heart disease, (5) disease of the large bowel including carcinoma and diverticulitis, (6) conditions of the vertebra and spinal cord, (7) tumors arising from the right adrenal gland, (8) carcinoma of the pancreas and ampulla of Vater, and (9) diaphragmatic hernia. All of these conditions may be misdiagnosed as gallbladder disease. Furthermore, these conditions may and frequently do occur in association with gallstones and therefore may be incorrectly diagnosed. The eliciting of a careful history would seem, in retrospect, to be the single most important part in evaluation of the patient. It is rare that any of these conditions mimic completely the symptoms and sequence of events seen in biliary tract disease. An accurate and complete history will provide the lead that should enable one to make the correct diagnosis so far as symptoms are concerned.

Peptic ulcer, for example, is more frequently encountered in young men than in young women. The pain it gives rise to is commonly allayed by taking food, in contradistinction to biliary tract disease in which food seems to add to a patient's distress.

Pancreatitis may simulate biliary colic or an acute cholecystitis. The location of the pain tends to be more in the midline and of a more severe nature although sometimes they are

indistinguishable. An elevated serum amylase is the most significant finding at the time of the attack but would be normal in the interval. If the pancreatitis is due to the biliary tract disease, relief of symptoms may be expected. Unfortunately this is not always the case.

Lesions of the right kidney are discernible if history, physical examination and urinalysis are evaluated in the light of their possible existence.

Coronary heart disease, usually increasing in incidence after the age of fifty but to be seen even in youth, is accompanied by signs and symptoms that rarely parallel those caused by gallstones. The older the patient the more attention one should direct to the possibility of cardiac disease particularly in the presence of hypertension.

Lesions of the large bowel that cause some degree of obstruction may give rise to complaints that are similar to the indigestion associated with biliary tract disease. Abdominal distention is not a common accompaniment of chronic biliary tract disease. Acute cholecystitis and carcinoma of the hepatic flexure may be difficult to differentiate on physical examination but with x-ray examination (barium enema), evidence in favor of one or the other is easily obtained.

Conditions of the spine and lesions of the spinal cord that cause pressure upon the tenth to twelfth thoracic nerves may likewise lead one into the false path. Here again the history is seldom even compatible with conditions arising within the biliary tract. Most of these can be demonstrated by a complete physical examination.

Tumors arising from the right adrenal gland may produce symptoms that are attributed to stones in the gallbladder because of their location in the right upper quadrant. We have seen three patients with a pheochromocytoma on the right side who were regarded as suffering primarily from cholelithiasis. We are aware of several other instances in the recent experience of other surgeons. Differential diagnosis, if the possibility is kept in mind, is not difficult. Other tumors including those that are malignant do arise from the adrenal gland and can be diagnosed by a variety of measures.

The pain of carcinoma of the body and tail of the pancreas has led to cholecystectomy as have symptoms of obstruction caused by tumors of the ampulla of Vater. Many authors have called attention to these lesions in particular. Sometimes at operation these may be overlooked unless a meticulous search for them is made.

Esophageal hiatal hernias may cause symptoms of indigestion compatible with gallbladder disease. These may be intermittent and are seemingly relieved by belching and the taking of soda. Hiatal hernia is rare in youth and not infrequent in the aged. For these reasons the older patient with gallbladder disease should be evaluated with this possibility in mind. X-ray examination should demonstrate its presence or absence.

COMMON DUCT STONE AND INTRAVENOUS CHOLANGIOGRAPHY

Indications for common duct exploration have been listed on the basis of findings at operation. We propose that we depend more upon the history and clinical findings. When these suggest the possibility of common duct stone then we favor intravenous cholangiography as an adjunct in guidance as to what is done at operation. Actually we still consider the indications we have used in the past at cholecystectomy in deciding whether or not to incise and explore the common duct. The information obtained from intravenous cholangiography stimulates us to be more persistent in our search for stones in the common duct if that examination is in favor of their presence.

Justification for this policy is based upon our experience [*4*] with seventy-two patients we reported upon. These patients had had intravenous cholangiograms and were operated upon.

Forty-six patients were diagnosed as having a normal common duct by intravenous cholangiography, nine were dilated without direct evidence of stones and sixteen were considered to show choledocholithiasis. There was a single instance of biliary enteric fistula. Of the forty-six patients whose intravenous cholangiogram was reported normal, indications for choledochotomy were present in the opinion of the surgeon in only seventeen. In two patients the duct was dilated but contained no stones, and in three stones were found and removed. It was concluded that forty-one of the forty-six patients were demonstrated to have a normal common duct at operation.

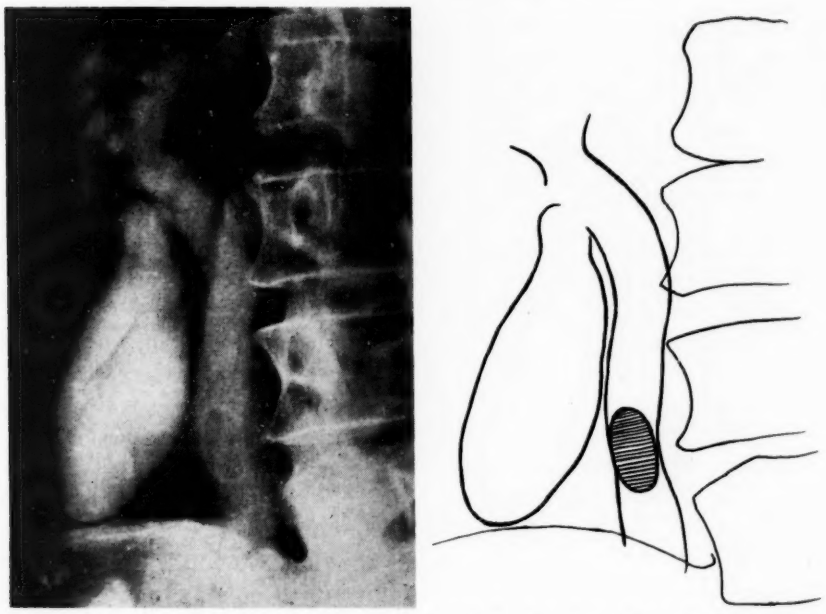


FIG. 1. Intravenous cholangiogram and artist's drawing of a calculus clearly visualized in the distal portion of the common duct in an eighty-three year old woman (NYH 789 709). Cholecystectomy for cholelithiasis and chronic cholecystitis together with removal of the common duct calculus was followed by complete relief of symptoms.

Of the nine patients whose intravenous cholangiograms indicated dilatation of the common duct without direct evidence of stone, only one was shown to be normal on exploration, five had stones and three were dilated without stones. The sixteen patients who were diagnosed as having choledocholithiasis were demonstrated at operation to have stones in fifteen instances. In one the common duct was found to be normal. Thus, in the series of seventy-two patients the diagnosis established by intravenous cholangiography was demonstrated at operation to be accurate in about 90 per cent.

Our present practice provides that a patient who is to have cholecystectomy only, because of clinical manifestations of gallbladder disease, and who has a history of findings compatible or suggestive of common duct abnormality is subjected to evaluation by intravenous cholangiography. If the common duct is considered by this method to have calculi in it by direct or indirect evidence, we are impelled to exhaust every means available to demonstrate or disprove their presence at operation. We are well convinced that this is a practical aid and that further experience will justify its use on this basis. (Fig. 1.)

Many of us who have had considerable experience in biliary tract surgery have been confronted with attempting to answer the question about common duct stones that manifest themselves in one way or another following cholecystectomy. Were these present and overlooked at the time the cholecystectomy was performed, or did they form later? Were they the result of the changes that take place in the common duct following cholecystectomy, or were they the result of the same disturbance that led to the formation of stones within the gallbladder? Although there is evidence in favor of both and admittedly there are unequivocal examples to be cited, we are of the opinion that persistence of stones with possible increase in size is more frequent in general than new stone formation in the common duct following cholecystectomy. This is our main reason for advocating the preoperative evaluation of the common duct by intravenous cholangiography when cholecystectomy is planned. Finally, it seems to us that there is some advantage to the surgeon if he embarks upon common duct exploration with a conviction that stones are present rather than resorting to frequent half-hearted attempts consisting of incision of the duct and a limited search for calculi. Such a philosophical ap-

proach may help in reducing the incidence of "postcholecystectomy syndrome," a term that is unflattering to those who employ it.

BILIARY ENTERIC FISTULAS AND GALLSTONE ILEUS

Biliary enteric fistula is a complication of biliary tract disease. Fortunately it is not common [5]. Its pathogenesis probably follows a general pattern. We visualize this process in the following steps: (1) A stone lodged in the ampulla of the gallbladder for several hours causes considerable reaction in the adjacent wall where the cystic artery enters, thus reducing the arterial blood supply. (2) At the same time venous and lymphatic drainage may be diminished. (3) As the first and second take place the absorption by the gallbladder of water from its contents ceases. (4) An increased intraluminal pressure, edema of the wall and further reduction of the blood supply causes the less vascular areas of the gallbladder to become ischemic and even gangrenous. The nearby adjacent serosal surface becomes irritated and inflamed and then adheres to the gallbladder. As the ischemic area in the wall of the gallbladder becomes gangrenous the increased pressure within results in its contents penetrating first its own necrotic wall and then causing a thrombosis and congestion of the wall of the adjacent viscera. Thrombosis of the vessels of the intestinal wall causes a necrosis so that a gross defect results. This is the beginning of the biliary enteric fistula.

The decompression of the tense gallbladder, by discharge of its contents into an adjacent segment of the intestinal tract, is followed by the dislodgment of the obstructing stone. This then may pass into the intestine. If small it is carried on to be evacuated through the rectum. If it is large it may cause obstruction of the intestine. The terminal ileum, being the smaller in diameter, is a frequent site in which such a stone becomes lodged.

The diagnosis is not difficult to establish particularly if one maintains a considerable degree of suspicion among those patients in whom intestinal obstruction develops and who are known to have gallstones.

The majority of patients with biliary enteric fistula have symptoms undistinguishable from those with chronic cholecystitis and cholelithiasis. Among this group an oral cholecystogram rarely results in visualization of the gallbladder or any part of the ductal system. In the course of such an examination, however, air may be seen in the biliary tree. Such a finding requires a further investigation. Barium studies that outline the stomach, duodenum and small bowel may nicely demonstrate the fistula with passage of the opaque media into the gallbladder or ductal system. Failure to demonstrate a communication by this procedure when air has been visualized within the biliary tract is an indication to attempt to find it by barium enema.

The triad [6] of small bowel distention, air in the biliary system and a laminated gallstone in the terminal ileum enables the roentgenologist to confirm the diagnosis of a biliary enteric fistula. On a basis of history and physical examination the clinician readily recognizes small bowel obstruction. If this has been preceded by symptoms of chronic biliary tract disease or acute episodes compatible with an obstructive cholecystitis, he will be alerted to the possibility of a recently developed biliary fistula. The presence of jaundice or a history of recurrent jaundice in addition should lead to specific examinations to establish the correct diagnosis. An improvement in the treatment of biliary enteric fistulas is dependent upon accurate diagnosis. Preoperative preparation and indicated surgical procedures should provide correction with relative ease and safety to the patient.

My purpose in calling attention to this condition is to emphasize that improved results in the treatment are dependent upon a full understanding of the abnormal physiological responses that result from it [7].

Small bowel obstruction is a surgical emergency. Unrelieved, it may rapidly terminate in death. When it occurs in association with a biliary enteric fistula and as a result of a gallstone the same statement remains applicable. The relief of the intestinal obstruction is of first importance and the correction of the fistula is secondary. If it is suspected that an intestinal obstruction is due to a gallstone or gallstones in the small bowel, we believe that treatment by indwelling gastrointestinal tube decompression is contraindicated and that operation should be undertaken as soon as the patient has been adequately prepared. At operation relief of the intestinal obstruction

is the primary objective. The gallstone is impacted most commonly in the terminal 50 cm. of ileum. The bowel proximal to the obstruction is distended with fecal material, and the adjacent wall in friable and edematous. The intestinal wall that engages the stone may vary from being the site of mild inflammatory reaction to complete necrosis with perforation. If this segment of bowel is viable the stone may be dislodged into the distended proximal segment and removed through an ileotomy. If there has been a perforation or if the bowel wall is not viable then this area where the stone was lodged should be resected and end-to-end anastomosis performed. Nothing more should be done at this operation. Therefore, when the patient has recovered from the operation and the intestinal obstruction, complete evaluation should be made seeking in particular to determine the exact location of the fistula and the status of the biliary tract. We are convinced that any definitive attack upon the fistula or biliary tract is contraindicated in the presence of acute intestinal obstruction caused by a gallstone.

There is great variation in what is to be found at operation. No two cases are alike. Certain objectives and procedures to attain them may be stated. These include choledochotomy with common duct decompression, cholecystectomy, excision of the fistula and closure of the intestinal defect. Location of the fistula may determine the course one follows. If the fistula involves the stomach, duodenum or jejunum the first step will be to dissect and separate its components. The defect in the intestinal wall is usually small and readily closed. In the event this is large and its closure likely to narrow the lumen of the intestine then resection and end-to-end anastomosis are recommended. Thereafter the common duct should be explored and any obstructing material within it removed. The gallbladder is removed and T tube drainage of the common duct established. If there is any definite degree of inflammatory reaction or scarring of the distal portion of the common duct, a T tube with a long arm that extends into the duodenum is used. (Fig. 2.)

In those instances in which the fistula involves the colon the sequence in accomplishing these steps may be changed with some advantage. For example, exploration of the common duct followed by cholecystectomy, leaving intact the cholecystocolic fistula until one is ready to divide it and invert the defect in the wall of the colon, should reduce the extent of contamination of the bowel contents.

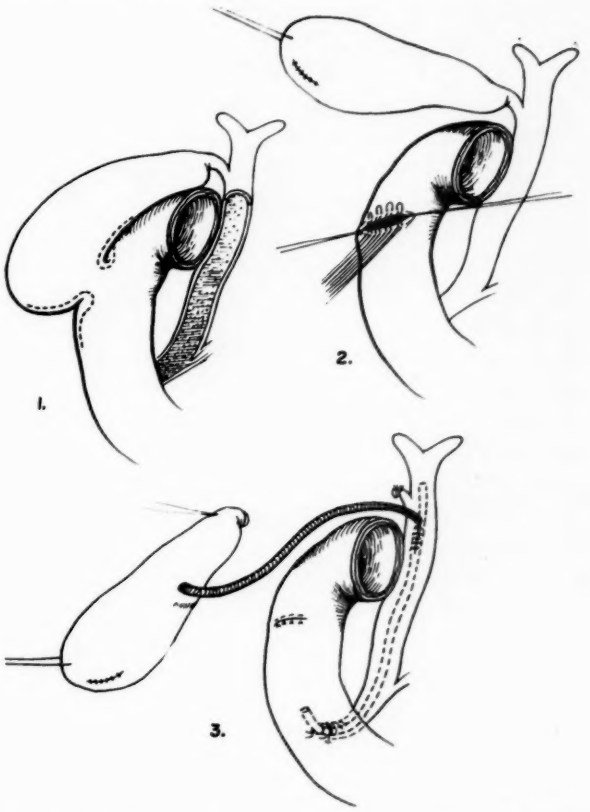


FIG. 2. Surgical correction of cholecystoduodenal fistula. (1) The common duct distal to the cystic duct is usually occluded with "biliary mud." Bile reaches the duodenum through the fistula. (2) The fistula tract is divided and the intestinal wall defect repaired. Both the gallbladder and the cystic duct to its junction with the common duct are dissected free. (3) After exploration of the common duct and the removal of any material within it, the gallbladder is removed. A T tube with a long arm extending through the ampulla of Vater into the duodenum is employed for decompression.

Biliary enteric fistula encountered in the course of cholecystectomy requires careful consideration of several factors before making a decision. The first of these is the general condition of the patient. Many, in fact the majority, are in the older age group in which there is a higher incidence of some impairment of various physiological functions that render them poor operative risks for extensive procedures that may be followed by massive infection. Long-standing biliary tract disease

with a biliary enteric fistula may be associated with liver damage. The second factor of importance is the site of the fistula, whether it involves the upper intestinal tract or the large bowel. The hazard of infection is much greater if the large bowel is involved and of course unprepared by preoperative chemotherapy and cleansing. If the fistula is between the common duct and the intestinal tract with surrounding inflammatory reaction, a palliative or compromise procedure that will permit this to recede may be preferable to a definitive procedure that requires extensive dissection. The third factor is the extent of common duct involvement and the presence and intensity of jaundice. If the patient is jaundiced, if there have been recurrent attacks of cholecystitis and if there is impacted calcareous material in the distal segment of the common duct then care should be exercised to keep the operative procedure and the disturbance it may lead to within the capacity of the patient. The young and robust patient usually has great tolerance and may withstand the indicated choledochotomy, cholecystectomy and dismantling of the fistula, and the repair of the intestinal defect. In the aged, the debilitated and the poor risk group it may be better judgment to provide common duct decompression and withdraw to return when preoperative planning, including large bowel preparation, may have been better anticipated and provision for serious possible sequelae has been made. Carcinoma is associated with fistula formation infrequently but in the older age group, particularly when fistulas are unexpectedly encountered, evidence for tumor spread should be looked for. Its presence determines somewhat the procedures to be undertaken.

TABLE I

MORTALITY RATE BY AGE GROUPS IN 4,585 PATIENTS FOLLOWING SURGERY FOR NON-MALIGNANT DISEASE OF THE BILIARY TRACT

Age	No. of Patients	No. of Deaths	Mortality Rate (%)
Under 50 yr.	2,533	15	0.59
50–64 yr.	1,602	35	2.18
65 yr. and over	450	29	6.44
Totals	4,585	79	1.72

BILIARY TRACT OPERATIONS IN PATIENTS SIXTY-FIVE YEARS OF AGE AND OVER

During a twenty-four–year period (September 1, 1932 to September 1, 1956) 450 cases of non-malignant biliary tract disease, in patients sixty-five years of age or over, were treated by surgery at The New York Hospital-Cornell Medical Center. There were twenty-nine deaths in this group, a mortality rate of 6.4 per cent. During the same period 1,602 patients, fifty to sixty-four years of age (with a mortality rate of 2.2 per cent), and 2,533 patients, under fifty years of age (with a mortality rate of 0.6 per cent), were treated for similar conditions. (Table 1.)

Diagnostic Classification. Three hundred eight of these geriatric patients were treated for chronic cholecystitis, 129 for acute cholecystitis and thirteen for postoperative and other benign strictures of the choledochus. The percentage of patients with acute cholecystitis as opposed to chronic biliary tract disease in the total series was 18.9 per cent among those under fifty years of age, 20.8 per cent among those fifty to sixty-four years of age, and 29.5 per cent among those sixty-five years of age and older.

Preoperative Evaluation. The presenting symptoms of biliary tract disease in the older age group varied little from the others. The more advanced changes in the biliary tract, resulting from long-standing disease such as common duct stone and biliary cirrhosis,

TABLE II

PREOPERATIVE EVALUATION OF 450 PATIENTS (SIXTY-FIVE YEARS OF AGE AND OLDER) IN RESPECT TO THE PRESENCE OF DEGENERATIVE DISEASE PROCESSES

Findings	No. of Patients*	No. of Non-fatal Complications	No. of Deaths
No major degenerative disease	153	22 (14.4%)	4 (2.6%)
Hypertensive cardiovascular disease	172	29 (16.8%)	13 (7.5%)
Arteriosclerotic heart disease	97	17 (17.5%)	8 (8.2%)
Diabetes mellitus (moderate to severe)	24	3 (12.5%)	.....
Chronic pulmonary disease	36	4 (11.1%)	2 (5.5%)
Cirrhosis	8	1 (12.5%)	2 (25%)
Chronic renal disease	8	1 (12.5%)	2 (25%)
Miscellaneous major chronic disease	41	7 (17.07%)	3 (7.32%)

* Seventy patients are classified in two groups, seven in three groups, two in four groups and one in five groups.

were of course more frequent. The differences observed in the older age group in comparison to the younger patients included the systemic degenerative changes, all of which have a bearing on the outcome of any surgical therapy. (Table II.)

One hundred fifty-three patients (not the largest group) were regarded as having no major degenerative disease process. These patients did have some degree of generalized arteriosclerosis, osteoarthritis, diverticulosis or benign prostatic hypertrophy. They did not have the disease processes listed to a major degree. There were twenty-two non-fatal complications (14.4 per cent) and four fatalities (2.6 per cent) among the aged patients in this group without recognized major disease processes.

Hypertensive cardiovascular disease was present in 172 patients (the largest group). These were patients with a sustained systolic blood pressure of over 160 or a diastolic blood pressure of more than 90. They had enlarged hearts with left ventricular preponderance. The highest consistent pressure was 230/120 mm. Hg. There were no cases of malignant hypertension. Twenty-nine non-fatal complications (16.8 per cent) and thirteen deaths (7.5 per cent) occurred following surgery in this group.

Arteriosclerotic heart disease of a significant degree was noted in ninety-seven patients. These individuals had sustained previous coronary occlusion (by electrocardiographic study) or had demonstrated electrocardiographic changes of a less marked degree associated with angina pectoris or cardiac decompensation. There were seventeen non-fatal complications (17.5 per cent) and eight (8.2 per cent) deaths in this group following surgical intervention for biliary tract disease.

Diabetes mellitus of a degree requiring a significant amount of insulin daily was present in twenty-four cases. There were three non-fatal complications (12.5 per cent) and no postoperative deaths in this group.

Severe chronic primary pulmonary disease was present in thirty-six cases, consisting of severe emphysema and bronchiectasis. There were four non-fatal complications (11.1 per cent) and two fatalities following surgery among these patients.

Cirrhosis, complicated by either hemorrhage from esophageal varices, ascites or jaundice, was present in eight instances (by preoperative evaluation). There were two postoperative deaths (25 per cent) in this group following biliary tract surgery.

The most striking conclusion to be drawn from an analysis of these patients is that an elective biliary tract procedure is tolerated remarkably well by the geriatric patient; in fact the difference in the complication rate and mortality rate between the aged (over sixty-five years) and the control group (fifty to sixty-four years) is not great. In contrast, the aged patient tolerates relatively poorly emergency biliary tract procedures, either for simple acute cholecystitis or for acute cholecystitis with choledocholithiasis. Both mortality and complication rates are strikingly higher than in patients in younger age groups [8,9]. This observation supports the concept that elective cholecystectomy in the aged patient with symptomatic biliary tract disease is even more important than in the younger patient, who can better tolerate the emergency procedure if such becomes necessary. The aged patient, even with advanced degenerative disease processes, when carefully evaluated and prepared for surgery, may be operated upon with a mortality rate of less than 2 per cent. In acute cases the improvements in all types of preoperative and postoperative care of patients undergoing biliary tract surgery have produced notable reductions in mortality and complication rates in the younger age groups, but in the aged the mortality for such procedures remains above 5 per cent.

In any discussion of biliary tract conditions requiring surgery one should keep in mind the possibility of acute cholecystitis developing after surgery directed at some other organ or system. Over the past ten years several reports have emphasized that acute cholecystitis is a complication that is not rare following surgical procedures. It is most frequently seen in the older patients who have gallstones albeit these may not have been previously recognized. Fasting, with the consequent storage of concentrated bile in the gallbladder and the sudden attempt of that organ to empty itself when food is taken, is believed to provide the mechanism for the production of a fulminating obstructive type of acute cholecystitis. The failure to recognize and treat acute cholecystitis properly in the aged may be followed by perforation of the gallbladder, peritonitis and death.

TECHNICS OF OPERATION AND IMMEDIATE POSTOPERATIVE COMPLICATIONS

The technical steps that a surgeon may follow in performing cholecystectomy and/or choledochotomy are varied. For the experienced, one method is as good as another; for the inexperienced, the safest approach is the best [*10*]. The following steps in performing cholecystectomy offer, I believe, the greatest protection. It should be emphasized that normal anatomical relationships of the gallbladder and ductal system prevail in less than 70 per cent of patients. Alertness to variations and positive identification before division of any structure in this area provide safety against inadvertent injury.

1. If the gallbladder is acutely inflamed or distended it is decompressed by aspiration with a trocar. This facilitates the exposure of the biliary fossae and in particular the cystic and common duct and cystic artery.

2. The peritoneum is then incised parallel to the common duct in the apparent area of its junction with the cystic duct. The cystic duct is dissected sufficiently to pass a silk ligature about it for identification purposes. The dissection is extended cephalad and laterally toward the gallbladder wall to expose the cystic duct.

3. The cystic artery is identified and dissected from its entrance into the gallbladder wall to its origin from the right hepatic artery. It is then temporarily ligated by setting one knot in the silk ligature.

4. The peritoneum over the gallbladder is incised 1 cm. from its junction with the liver, and the gallbladder is dissected from its liver bed from the fundus toward the cystic duct.

5. The branches of the cystic artery are encountered as they enter the wall of the gallbladder. They are divided and the cystic artery is permanently secured by ligature and transfixing suture.

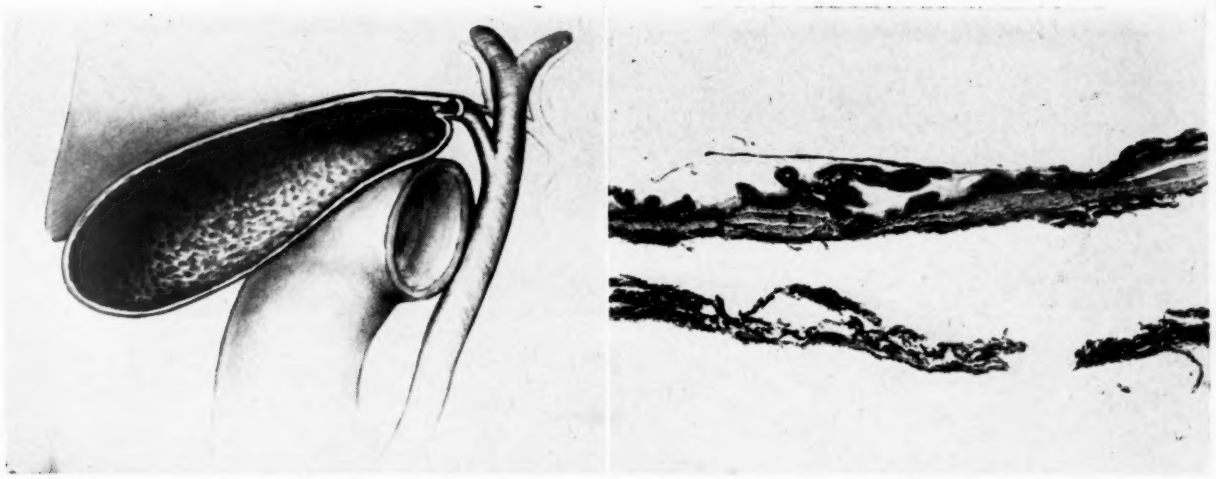
6. The cystic duct is dissected down to its true junction with the common duct. It is secured with a ligature of No. 3-0 plain absorbable surgical suture, U.S.P., 3 mm. from its junction. Just proximal to this is placed a transfixing suture of fine silk, the cystic duct is divided and the gallbladder is removed.

In acute cholecystitis the lymph gland, commonly located between the cystic artery and the cystic duct, is usually enlarged. In chronic cholecystitis it may be scarred and contracted, distorting both cystic artery and cystic duct. In both, this may render the separation of these two structures difficult. Careful dissection in this area is mandatory for safety.

Exploration of the common duct should be undertaken when there is reason to believe calculi are present. The surgeon under such circumstances is quite likely to be more thorough than if he follows a policy of incising the common duct in the course of performing cholecystectomy and makes a limited search for calculi. We believe that if there are indications for choledochotomy before operation and the patient is not jaundiced, intravenous cholangiography may provide specific valuable information.

If the gallbladder has been dissected from the fundus downward and the cystic artery divided, the cystic duct may be used to introduce a catheter into the common duct to obtain an operative cholangiogram. Common duct exploration may be accomplished through a 2 to 3 cm. incision just distal to the true junction of the cystic with the common duct. Following exploration of the common duct and the removal of stones, the wall of the common duct is reapproximated with interrupted sutures. External drainage following choledochotomy affords the greatest protection against bile leakage. This hazard, always present after common duct exploration, is further diminished by establishing a bile-tight closure of incisions in the duct and about drainage tubes. The somewhat higher incidence of postoperative complications among patients having choledochotomy as compared to those having only cholecystectomy is probably the result of escape of bile. Decompression of the common duct can be established by a catheter placed through the cystic duct or a T tube with its long arm brought out through the upper extremity of the incision. In either instance the importance of a bile-tight closure of the common duct is stressed. The incision of the common duct is closed with interrupted sutures of No. 3-0 plain catgut that go through the entire duct wall. This suture line is reinforced and partially inverted with interrupted sutures of No. 5-0 silk.

Cholangiography eight to ten days after operation provides a means of evaluating the ductal system before removal of the drainage tube. From time to time we have demonstrated an unsuspected calculus.



3A 3B

FIG. 3. A, schematic drawing of normal gallbladder. B, photomicrograph of the wall.

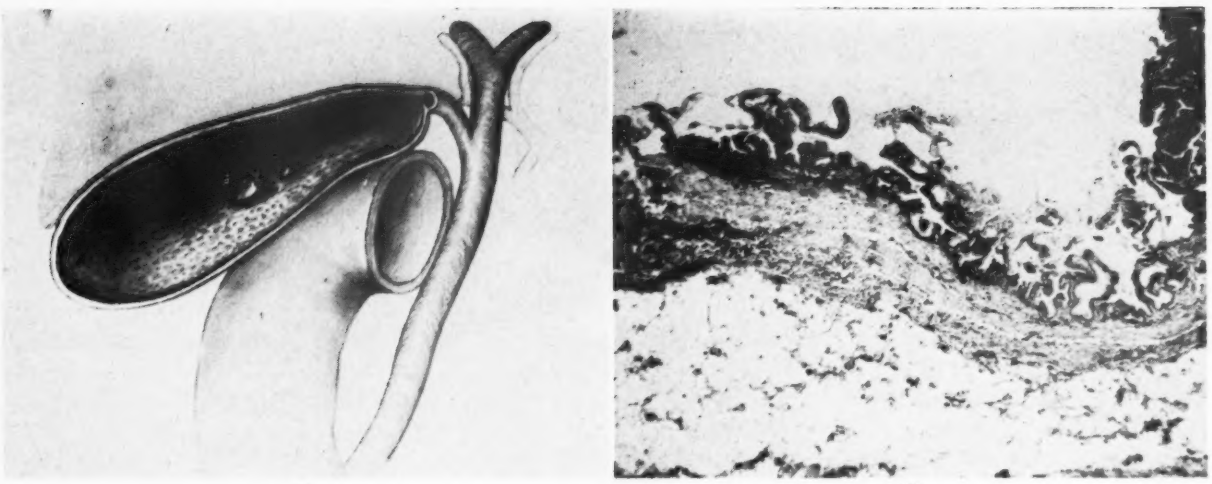
CLASSIFICATION OF BILIARY TRACT DISEASE

Perhaps a word of explanation is appropriate here. There is considerable evidence [*11*] indicating that operations upon the biliary tract are among those most frequently performed in the hospitals of the United States. It has been our experience at The New York Hospital-Cornell Medical Center that diseases of the biliary tract are on the increase and that more surgical procedures are being performed in this area. In 1935 operations on the biliary tract were only the third most common procedure. Now, twenty-odd years later, these operations are the most frequently performed. In 1935 [*12*] 126 biliary tract operations were performed on the pavilion service and in 1956 [*13*] there were 241. The surgeons, more than other physicians, are gaining a wide experience that merits reporting. It would serve a useful purpose if we were to employ common terms in our writing. Taking a lead set by the American Heart Association establishing terms in describing heart disease, a classification of biliary tract disease as viewed from the surgeon's point of view is presented. (Fig. 3.) It is incomplete and may or may not be practical.

The pathogenesis of calcareous biliary tract disease lends itself to division into four stages. These can be readily demonstrated by the clinical symptoms and findings they give rise to and/or the pathological changes that are to be observed at operation or postmortem. These occur in sequence and the changes that take place are in a sense accumulative; thus, findings of the later stages are superimposed upon the earlier. In general these changes are not reversible. Each stage may undergo phases from which it recovers with or without structural changes. For example, acute obstructive cholecystitis may occur in any of the four stages, reach a peak of involvement and then subside without having resulted in structural changes that would alter its stage.

The description of the stages, supplemented with illustrations, are presented to portray the possible course of events if the gallbladder containing stones is not removed. Because stones are associated with all biliary tract disease in over 90 per cent of instances, they are accorded a prominent role.

Stage One. (Fig. 4.) Stone or stones that have recently formed are generally present although they may have existed for varying periods of time. The gallbladder functions well as demonstrated by cholecystography; it fills readily with the contrast material and it empties following a "test" meal. On examination at operation the gallbladder is nearly normal in appearance and on palpation the wall is only slightly, if at all, thickened. Sections selected from different areas of the gallbladder and viewed under the microscope show an absence of significant pathological changes. Also included are those patients who, in the absence of calculi, have had recurrent episodes of acute cholecystitis and as a result have minimal changes of chronic cholecystitis. Grossly the gallbladder is of normal size, gray rather than blue in color, and on palpation



4A 4B

FIG. 4. A, schematic drawing of stage one. B, photomicrograph of the wall. At operation the gallbladder is almost normal in appearance. Palpation reveals slight thickening and usually one or more stones. On microscopic examination there are minimal pathological changes. Calculi in the common duct are rare.

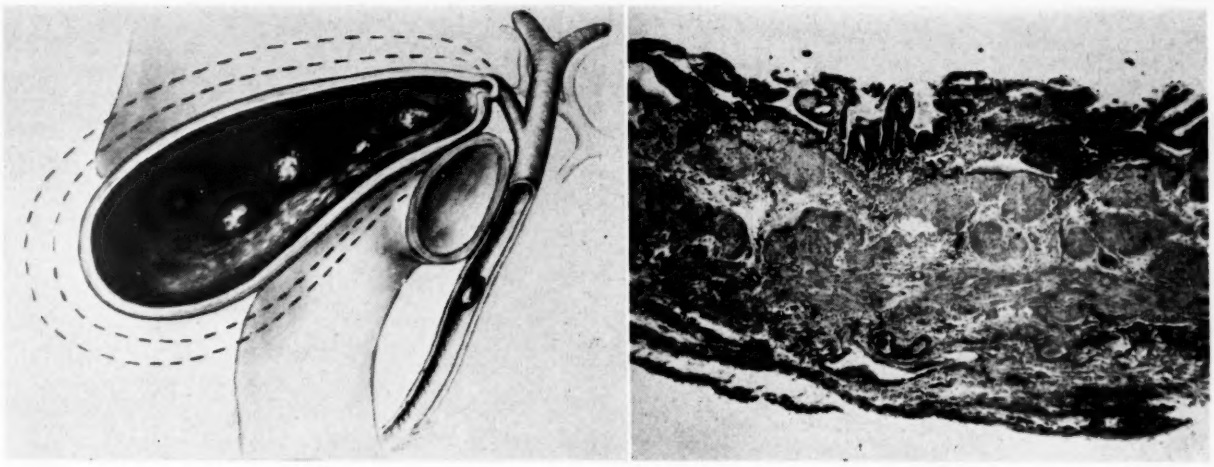
there is thickening. Microscopic examination demonstrates scarring and chronic inflammation of somewhat greater degree than in those with stones. The liver is normal in appearance and free of detectable injury from recurrent cholangitis or episodes of ascending infection, the result of, or in relation to, any episode occurring within the gallbladder.

This stage is seen in young women recently pregnant, perhaps the majority in their twenties. It is also seen in a somewhat older group of women (who have not been pregnant) and men, generally in the age range of thirty to forty-five years. It may also be observed in children as well as adults with blood dyscrasias in which there is excess red blood cell destruction.

Although this stage, once established, is usually associated with continued activity of the disease of the biliary tract and in time undergoes changes that place it in stage two, it may remain quiescent and unchanged for years. Perhaps the best known example is that of the single spherical cholesterol stone in the well functioning gallbladder. Although we do not know the etiology of gallstones or understand all the numerous mechanisms that may be involved, it seems reasonable to assume that a single stone may be formed and remain in the gallbladder for years without causing obstruction, a sufficient impairment of function to produce symptoms or additional changes in the biliary system. Such a possible innocuous course, percentagewise, may be of little significance but provides an explanation for the findings of stage one occasionally in old people. We favor this concept in preference to the one that projects the precipitous formation of stones for the first time in patients aged sixty-five years and older.

Stage Two. (Fig. 5.) Stones have been present for a considerable time and gallbladder function has become impaired. The gallbladder is faintly visualized by cholecystography if the contrast material enters it readily from the common duct but it is not well concentrated. Following a "fatty" meal the gallbladder may empty incompletely. At operation the gallbladder is enlarged, its color gray rather than blue, and on palpation the wall is unquestionably thickened. The liver grossly appears normal in color, size and texture. However, on microscopic examination signs of scarring are often present.

In from 7 to 15 per cent of patients, stones are present in the common duct. It is estimated that the ordinary patient with chronic cholecystitis and cholelithiasis falls into this group. Some do not advance beyond it. Postmortem examination may reveal this stage of biliary tract disease with no known history of symptoms, the individual having died from some unrelated condition. It is probable that the great majority of patients in this stage continue to have advancement of the disease with consequent changes representing a wide range of variation throughout the entire biliary system.



5A 5B

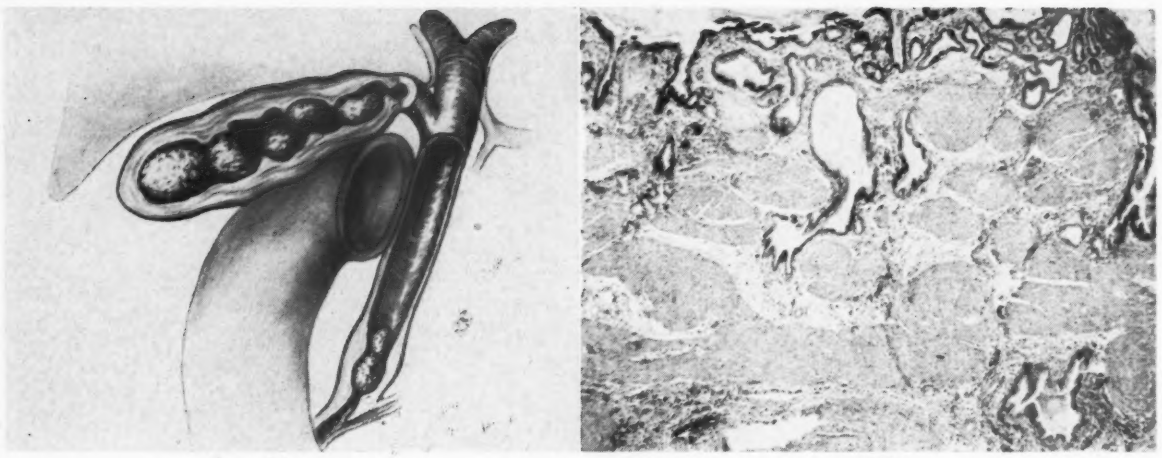
FIG. 5. A, schematic drawing of stage two. B, photomicrograph of wall. At operation the gallbladder is enlarged, its color gray rather than blue, and on palpation the wall is moderately thickened. Usually there are many gallstones; if, however, only one or a few gallstones are present, the size of the stones is large. Microscopic examination of the gallbladder reveals scarring with varying degrees of inflammatory reaction. Common duct calculi are present in about 12 per cent. This is the stage most frequently encountered in our experience.

That more patients subjected to operation at present are classified in stage two than in the other three stages merits some discussion. First, it may be said that stage one is made up for the most part of young individuals whose complaints or symptoms, if minimal, may escape diagnosis. Second, if diagnosis is established they may feel that their symptoms are not sufficient to demand operation. Those in the older age group in stage one are often without symptoms and have had a diagnosis established by a complete clinical evaluation. The gallbladder containing stones and in which intermittent obstruction and recurrent episodes of infection takes place is quite likely to give rise to increasing symptoms and disability. With each insult or injury from these episodes changes in the biliary tract result, such as thickening and scarring of the gallbladder wall, increase in the number and size of stones, and formation of or passage of stones into the common duct. In many instances injury to the liver results from cholangitis, an ascending infection that involves both the finer canaliculi and liver cells. Acalculous cholecystitis is included in stage one. It rarely progresses into the later stages; however, instances of common duct stone without cholelithiasis are encountered from time to time. When this situation exists it may best be considered in stage two.

Stage Three. (Fig. 6.) Stage three is less frequent than stage two. It is readily recognized and represents an advanced development in the course of the disease. Stones have been present in the gallbladder for a long time. The wall is contracted down about them. The gallbladder no longer functions. In attempted cholecystography contrast material does not enter. Sometimes calculi containing calcium are evident on simple roentgenograms. Stones in the common duct are more frequently present than not. Injury with scarring in the liver may be minimal and scarcely evident on inspection, or it may be extensive as a biliary cirrhosis. Confirmation of the degree of hepatic cirrhosis is dependent upon the findings on microscopic examination.

The manifestations of this stage are often dramatic. The patient is seized with severe pain in the upper abdomen that radiates to the back and right shoulder. This is followed within an hour or two with a chill and high fever. Several hours later there is jaundice. This was emphasized long ago by Charcot as due to stones obstructing the common duct. This late stage of biliary tract disease is accompanied by the injury to the liver that has accumulated during the previous two stages. It may be great or little. If the patient is elderly and biliary tract disease has been long present, then it, in combination with the limitations of physiological function of the aged, may be fatal if not corrected.

The treatment of biliary tract disease in



6A 6B

FIG. 6. A, schematic drawing of stage three. B, photomicrograph of the wall. The gallbladder at operation is smaller than normal, usually being contracted about stones that fill the lumen. On microscopic examination there is great scarring of the wall with distortion and/or destruction of the mucosal surface. Common duct calculi are more frequently present than not.

this stage carries with it a mortality and morbidity rate that is higher than in the first two stages. With an ever-increasing proportion of our population living into the older age group (sixty-five years and over) it is to be expected that this stage will be seen more frequently. In the course of another generation or two this should change because the surgical treatment is becoming safer and easier for patients. This, coupled with a more alert medical profession establishing diagnosis earlier, should see biliary tract disease interrupted before it reaches stage three.

Stage Four. (Fig. 7.) The continuation of active biliary tract disease as described in the previous stages (one, two and three) is so frequently the course of events that it may be anticipated and is the basis for prognosis. Other developments that may occur in the wake of the disease do not seem to fit in well with stage three. These are unpredictable and occur in association with biliary calculi, but we are not always able to demonstrate cause and relationship among them. Thus in stage four are placed those conditions that, although preceded by those in the first three stages, actually constitute distinct entities from the standpoint of clinical manifestations and pathology. Included in this category are (1) cirrhosis of the liver and benign stenosing fibrosis of the ductal system, (2) biliary enteric fistula and (3) neoplasms including papillomas and carcinomas of the gallbladder as well as carcinoma of the bile ducts.

Carcinoma of the gallbladder is rarely (5 to 10 per cent) found except in association with cholelithiasis. Malignancy of the extrahepatic ductal system is found in about 50 per cent of instances in patients with calculi. The age and the long history of biliary tract disease suggest a causal relationship between stones and neoplasm. The poor prognosis by any known therapy renders this an irretrievable sequence. Benign stenosing fibrosis of the ductal system, although a rare condition in comparison to carcinoma, has an equally gloomy prognosis. It may or may not be preceded by calcareous biliary tract disease. Its origin and course are poorly understood. Cholecystoenteric fistula is a complication that may occur in any of the first three stages. (Fig. 8.) Once established, the fistulous communication may persist and be the cause of persistent intrahepatic infection and associated precipitation of additional material into the ductal system.

Phases in Relation to Stage. Each stage may be subject to changes or phases from which it recovers. For example, an acute cholecystitis (an inflammatory reaction) may be superimposed on any stage. This acute phase may be due to obstruction, infection or chemical action. Complete recovery with little residual scarring can take place so that the stage of the disease according to our criteria remains the same. On the other hand the acute phase may not subside. It may persist and become progressive, resulting

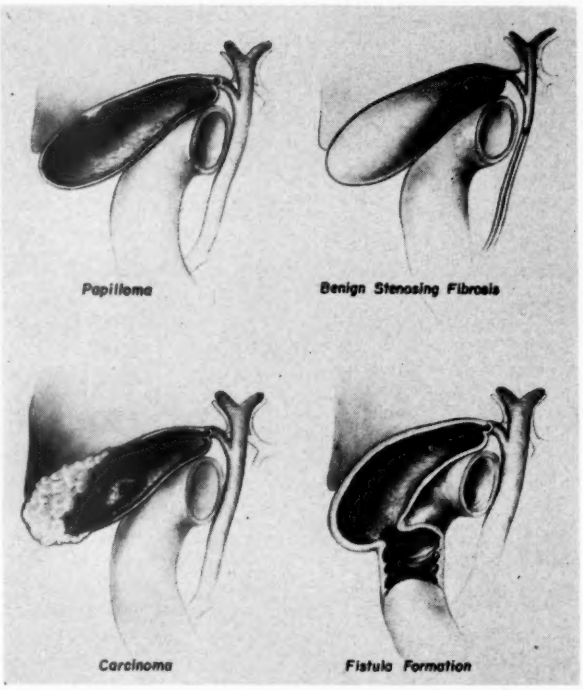


FIG. 7. Schematic drawing of stage four. Included in this category are (1) cirrhosis of the liver and benign stenosing fibrosis of the ductal system, (2) biliary enteric fistula and (3) neoplasms including papillomas and carcinomas of the gallbladder as well as carcinoma of the bile ducts.

in a complication such as perforation with peritonitis. If this occurred in stage one the changes in the gallbladder wall would then place it in stage two. Again, if the acute phase resulted in the formation of a cholecystoenteric fistula according to our classification it would be placed in stage four.

Acute cholecystitis may occur in the absence of calculi and accounts for 5 to 10 per cent of reported cases. There are several etiologic factors that contribute to this condition. They include bacterial infection that is derived from the liver, the blood stream and the lymphatic channels. Regurgitation of pancreatic juice is held by some to be of importance, as is also the reaction produced by bile salt concentration within the gallbladder. There are also circulatory disturbances such as arteritis and arteriolitis seen in association with terminal hypertensive cardiovascular disease and severe bacteremia.

There is frequently a history of a systemic infection due to one of many organisms such as Escherichia coli, staphylococci and hemolytic streptococci. An upper respiratory infection with superimposed secondary invaders is,

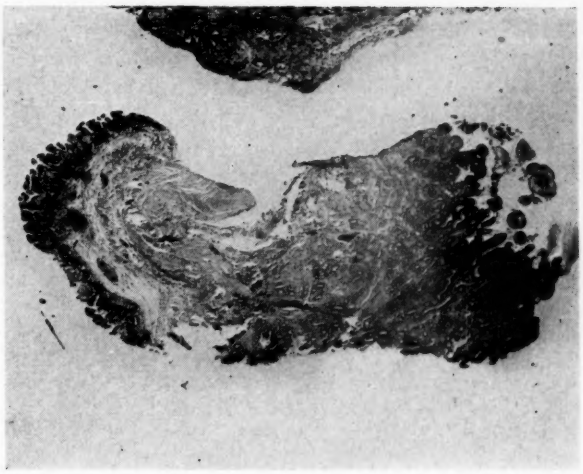


FIG. 8. Photomicrograph of cholecystoenteric fistula showing mucosa of gallbladder and duodenum.

for example, more frequently a precursor than is a localized infection such as osteomyelitis. An infection caused by a virulent organism which overwhelms the body resistance no matter where it gained its foothold may be accompanied by an acute cholecystitis. In years past, typhoid fever was a classic example of this.

Following the subsidence of an initial attack, there is healing of the ulcerations of the mucosal surface and scarring of the wall. Depending on the amount of tissue destroyed by the infection, the function of the gallbladder may be impaired. This may be so slight that it is of no particular importance or it may be so marked that the gallbladder is no longer capable of receiving or concentrating bile. In either event this initial episode may be but the beginning of a long series of events in the advancement of biliary tract disease. It is likely that the organisms persist in the gallbladder and biliary passages and that there will be recurrent attacks. The alterations in function and the residual debris from the infection at its height may provide a nidus for gallstone formation.

SUMMARY

In a consideration of the current problems in the surgical treatment of biliary tract disease it has been emphasized that greater attention should be directed to diagnosis. The demonstration of gallstones or the failure of the gallbladder to be visualized by cholecystography does not exclude other conditions that may be the cause of the patient's symp-

toms. Common duct stones are one of the causes of the persistence or recurrence of symptoms following cholecystectomy. Intravenous cholangiography in those patients with a history indicative of or compatible with choledocholithiasis is suggested as an aid in securing evidence for exploration of the common duct in conjunction with cholecystectomy.

Long-standing biliary tract disease is associated with many complications rarely or never seen in youth. Some of these, if unrecognized and as a result not treated, often end fatally. Biliary enteric fistula formation with gallstone ileus is an example. Its diagnosis and management is discussed as a condition that may be seen with increasing frequency as the old age fraction of our population increases. For the geriatric group data are presented that focus attention upon the need for precision management of patients undergoing surgical treatment for biliary tract disease. A realization of the hazards inherent in those individuals sixty-five years of age and over because of deficient function in one or more of the principal organs or systems should result in the preoperative preparation and exercising of caution in embarking upon therapeutic surgical procedures.

Injury to the common duct in the course of the performance of cholecystectomy may be followed by consequences far more detrimental to the patient than the ordinary course of gallbladder disease. The technical steps believed to be most important in avoiding such inadvertent injury are presented in the description of retrograde cholecystectomy.

Because biliary tract disease occurs in individuals of all ages and varies so much in its course, often giving rise to serious complications, it is looked upon by many as a complicated and somewhat confusing clinical condition. In an attempt to facilitate the recognition of the disease in any of its various stages, phases and associated developments, a simple classification for descriptive purposes is presented. This is based upon the morphology and course of disease rather than upon the grouping of patients according to age, sex or physical habitus.

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A Postmortem Analysis of 812 Gastroduodenal Ulcers Found in 20,000 Consecutive Autopsies, with Emphasis on Associated Endocrine Disease

EDWIN H. ELLISON, M.D., *Milwaukee, Wisconsin,* JEROME S. ABRAMS, M.D., *Cleveland, Ohio,* AND DARELL J. SMITH, M.D., *Columbus, Ohio*

From the Department of Surgery, The Ohio State University Health Center, Columbus, Ohio. This study was supported in part by an institutional grant from the American Cancer Society.

RECENT observations by a number of investigators indicate that there may be more than a casual relationship between the endocrine system and acid-peptic disease. Current medical literature, however, offers little information concerning the postmortem incidence of associated endocrine dysfunction in patients with acute or chronic peptic ulceration. Such data might prove of considerable import in evaluating newer concepts of the etiology of the ulcer diathesis. With this in mind, the autopsy records of patients with peptic ulcer at The Ohio State University Health Center were reviewed.

The records of 20,000 consecutive autopsies performed in Columbus, Ohio, from 1937 to 1955 were studied. Eight hundred twelve active gastroduodenal ulcers were found, an incidence of 4.1 per cent. This figure closely agrees with the results of earlier surveys (Table 1) in which, except for the data of Lockwood [31] and Gordon and Manning [18], the incidence of all ulcers found at autopsy was between 4 and 5 per cent.

The survey included autopsy archives from one university hospital, one charity hospital, two state mental institutions, one geriatric home, one pediatric hospital and six community hospitals, thus representing a cross section of postmortem findings in an entire city population and meeting the requirements recommended by Ivy et al. [27] for the evaluation of autopsy data.

Only those lesions showing a discrete loss of mucosa with acute or chronic inflammatory reaction are included. Healed ulcers or scars, suggesting previous ulceration, "erosions" and specific ulcerations, e.g., tuberculous or malignant, have been omitted.

Each archive was screened for the following information: age, race, sex, pertinent history, including predominant symptoms of ulcer and their duration; recent or remote surgery for ulcer; previous history of endocrine disease; the location, size, number and type, i.e., acute or chronic, of the ulceration; associated pathologic condition of the gastrointestinal tract, the central nervous system and the endocrine organs; and finally the immediate cause of death. The data were then transferred to IBM cards to facilitate sorting.

Type of Ulcer. The differentiation of the acute from the chronic lesion was based on the

TABLE 1
COMPARISON OF POSTMORTEM INCIDENCE OF PEPTIC ULCER IN THE UNITED STATES IN SEVERAL SERIES

Author	Year	No. of Autopsies	Incidence of Ulcers (%)
Welch [47]	1894	32,052	5.00
Fenwick and Fenwick [14]	1900	47,912	4.20
Lockwood [31]	1913	19,315	1.23
Bassler [2]	1926	59,450	4.40
Portis and Jaffe [35]	1929–1936	9,171	4.90
Gordon and Manning [18]	1920–1937	22,956	2.75
White [50]	1940–1950	8,123	4.70
The Ohio State University	1937–1955	20,000	4.06

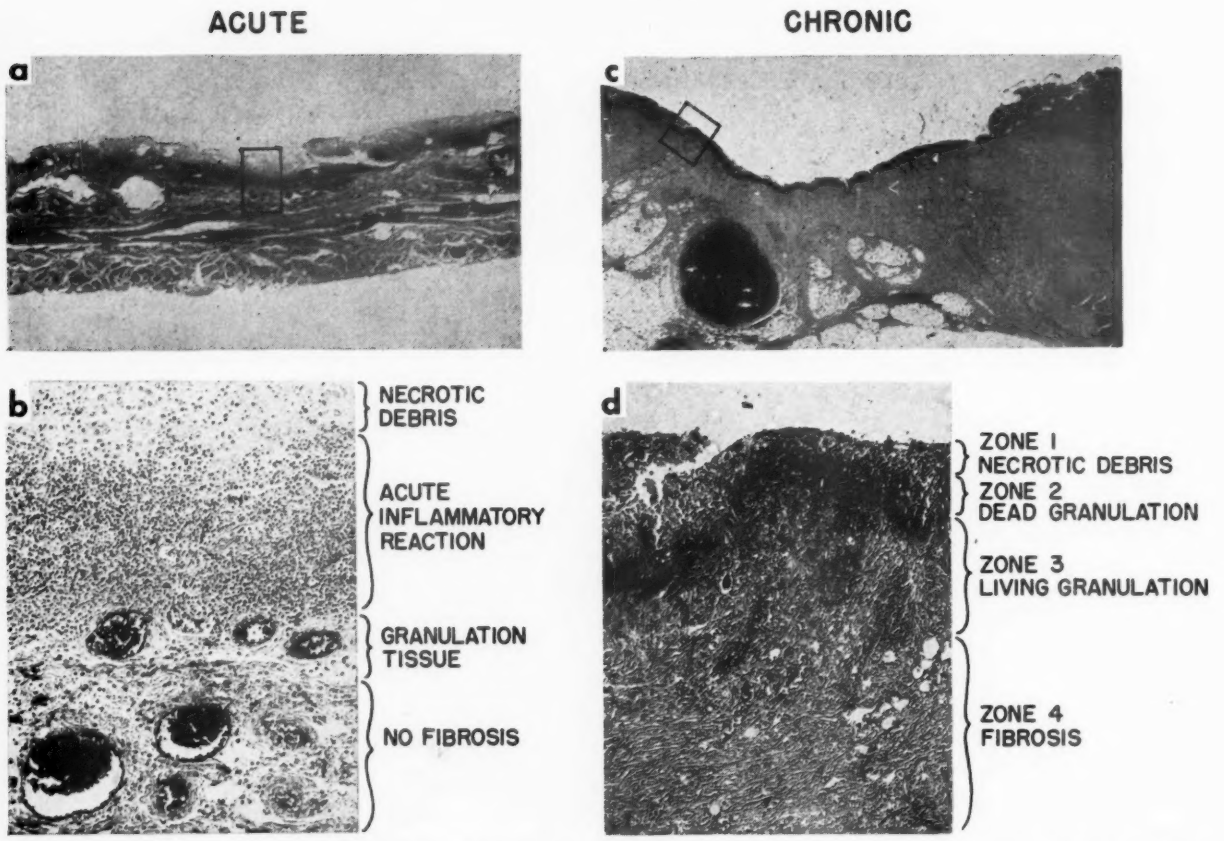


FIG. 1. Gastric ulcer. A, low magnification of an acute gastric ulcer. The section shows postmortem autolysis. Hematoxylin-eosin stain. B, high magnification of ulcer shown in (A). There is no evidence of fibrosis. Hematoxylin-eosin stain. C, low magnification of a chronic gastric ulcer. The gastric musculature ends abruptly at the base of the ulcer. Note the large thrombosed vessel. Hematoxylin-eosin stain. D, higher magnification of (C), demonstrating the four zones described by Boyd [5]. Hematoxylin-eosin stain.

criteria established by Boyd [5]. Those classified as acute ulcers represent a discrete loss of mucosa, are usually shallow although they may penetrate to the serosa and even perforate, are associated with an acute inflammatory reaction and show no evidence of fibrosis. (Fig. 1A and B.) The four zones described by Boyd in the typical chronic ulcer are seen in Figure 1C and D.

The distribution of ulcers according to type and general location is shown in Table II. Of the 812 ulcers, 389 (48 per cent) were duodenal and 372 (46 per cent) were gastric, the ratio of gastric to duodenal being approximately 1:1. This is in accord with other survey findings during the present century. (Table III.) The figures of Rokitansky [37] and Grünfeld [23] strengthen the belief that duodenal ulcer has become increasingly common, but it must be noted that their series were extremely small. Comparing the postmortem findings with those reported clinically, when duodenal ulcer is six to eight times more frequent, one can only guess that either gastric ulcer is a more fatal lesion or that it is not diagnosed as often as is duodenal ulcer.

Although, as noted, the ratio of all gastric to all duodenal ulcers was 1:1, it was 1.5:1 in acute lesions and 0.6:1 in chronic ulcers. The ratio of all acute ulcers (387) to all chronic ulcers (374) was also 1:1; in gastric ulcers it was 1.6:1, while in duodenal lesions it was 0.7:1. These figures support the concept that acute lesions are more common in the stomach, whereas chronic ulcers occur more frequently in the duodenum.

Twenty-one patients had acute ulcerating lesions in both the stomach and duodenum, and the combination of chronic gastric and chronic duodenal ulcer occurred in twenty-three cases, or 6 per cent of 374 chronic ulcers. Hurst and Stewart [25] found combined lesions in 5.5 per cent. It was of interest that none of the latter patients exhibited pyloric

TABLE II

INCIDENCE OF ULCER BY TYPE AND SEX IN 20,000 CONSECUTIVE AUTOPSIES

Type of Ulcer	Male Patients		Female Patients		Total	
	No.	% of 812	No.	% of 812	No	% of 812
Acute duodenal	105	13.0	52	6.5	157	19.5
Chronic duodenal	180	22.0	52	6.5	232	28.5
Acute gastric	149	18.4	81	9.9	230	28.3
Chronic gastric	101	12.4	41	5.0	142	17.4
Stomal	4	0.5	3	0.4	7	0.9
Acute duodenal and gastric	14	1.7	7	0.9	21	2.6
Chronic duodenal and gastric	15	1.8	8	1.0	23	2.8
Total	568	69.8	244	30.2	812	100.0

or duodenal obstruction. Thus six of every 100 patients coming to autopsy with chronic gastroduodenal ulcer can be expected to have ulcerating lesions of both organs. In addition to the aforementioned combination, there were twenty-one chronic duodenal ulcers complicated by acute gastric ulceration, and four cases of chronic gastric ulcer associated with acute duodenal lesions. For statistical purposes, these have been included with the type of chronic ulcer involved.

Sex. The ratio of male to female patients in all cases of ulcer was 2.3:1; in gastric ulcers the ratio was 2.0:1 and in duodenal ulcers it was 2.7:1. (Table IV.) These values are somewhat lower than those of other autopsy reviews. However, if only the figures for chronic lesions are studied, they more closely approximate earlier findings. The ratio of male to female patients with chronic gastric ulcers was 2.5:1, and in chronic duodenal ulcers it was 3.5:1.

Several sets of data from clinical reviews have been included in the table for com-

TABLE III

COMPARISON OF THE RATIO OF GASTRIC TO DUODENAL ULCER IN SEVERAL CLINICAL AND AUTOPSY SERIES

Author	Year	Country	Total Ulcers	Ratio of Gastric to Duodenal Ulcer
Clinical Series				
Eusterman and Balfour [13]	1935	U. S.	2,299	0.16:1
Mayo Clinic [54]	1935	U. S.	6,284	0.08:1
White [50]	1920–1945	U. S.	934	0.14:1
Autopsy Series				
Rokitansky [37]	1839	Austria	79	12.0:1
Grünfeld [23]	1882	Germany	126	30.0:1
Hurst and Stewart [25]	1939	England	374	1:1
Portis and Jaffe [35]	1929–1936	U. S.	436	1.1:1
Gordon and Manning [18]	1920–1937	U. S.	534	1.1:1
White [50]	1940–1950	U. S.	380	1.1:1
The Ohio State University	1937–1955	U. S.	812	0.96:1
			(Acute, 387)	(Acute, 1.5:1)
			(Chronic, 374)	(Chronic, 0.6:1)

TABLE IV

COMPARISON OF THE RATIO OF MALE TO FEMALE PATIENTS IN SEVERAL CLINICAL AND POSTMORTEM SERIES OF PEPTIC ULCER IN THE UNITED STATES

Author	Year	Total No. of Ulcers		Ratio of Male:Female Patients	
		Gastric	Duodenal	Gastric	Duodenal
Clinical Series					
Smith and Jordan [44]	1948	541	...	2.2:1	.....
Bockus [4]	1943	...	786	.....	4.2:1
White [50]	1951	112	934	1.1:1	6.3:1
Autopsy Series					
Portis and Jaffe [35]	1938	185	145	2.6:1	4.0:1
Gordon and Manning [18]	1941	213	162	2.3:1	3.1:1
White [50]	1951	202	178	2.5:1	3.3:1
The Ohio State University	1956	372	389	2.0:1	2.7:1
		(Acute, 230)	(Acute, 157)	(Acute, 1.8:1)	(Acute, 2.0:1)
		(Chronic, 142)	(Chronic, 232)	(Chronic, 2.5:1)	(Chronic, 3.5:1)

parison. Recently Dragstedt [10] has re-emphasized the equal incidence of gastric ulcer in male and female patients as seen clinically.

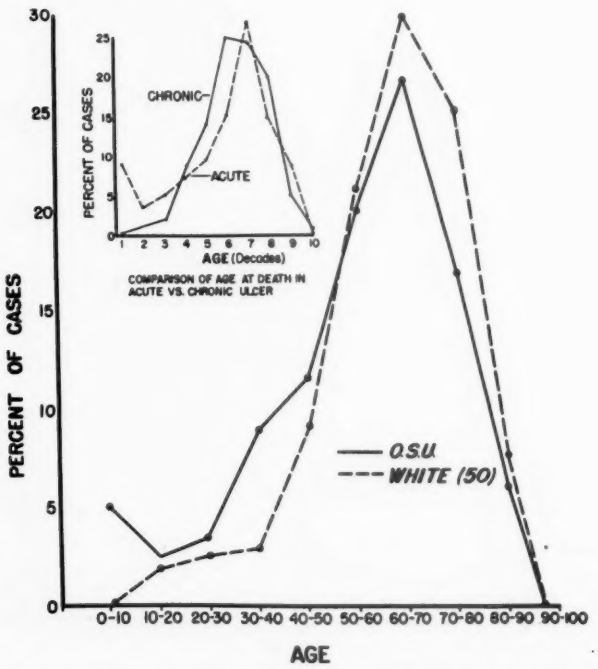


FIG. 2. Age of death of patients with gastroduodenal ulcer at autopsy. Comparison of two large series. The higher percentage of cases under ten years in The Ohio State University study may be due to the fact that a pediatric hospital was included in the series. The inset graph compares acute versus chronic lesions.

Race. In the current series there were 6.8 white patients for each Negro patient. The census of 1950 showed that in Columbus this ratio was 7:1. Thus it is apparent that the incidence of ulcer was identical in both the Caucasian and the Negro. Except for the twenty-one cases of combined acute ulcers, in which only one patient was Negro, all other lesions had a ratio remarkably close to 7:1.

Age. The peak age of death occurred between sixty and seventy years in both The Ohio State University and a similar series reported by White [50]. (Fig. 2.) The higher incidence of ulcers in patients under twenty years of age in our series is probably due to the fact that autopsy material from a pediatric hospital has been included.

Of the 374 chronic ulcers, none were found in infants less than one year of age, and only ten (2.7 per cent) were found in patients under thirty. By contrast, twenty-two (6 per cent) of 387 acute lesions occurred in children less than one year of age, and sixty-seven (18 per cent) were seen in patients before the age of thirty. The higher percentage of acute ulcers in the younger age group may be explained by the large number of lesions of the central nervous system, including bulbar poliomyelitis, which were frequently accompanied with gastroduodenal ulcerations, prob-

TABLE V

HISTORY OF SURGERY FOR ULCER IN 374 PATIENTS FOUND TO HAVE CHRONIC ACID-PEPTIC DISEASE AT AUTOPSY

Type of Ulcer	Time	Gastroenterostomy	Gastrectomy	Gastrectomy and Vagotomy	Surgical Closure	Total	
						No.	(%)
Chronic duodenal (232).....	Recent	17	11	1	8	37	16
	Remote	5	..	..	12	17	7
Chronic gastric (142).....	Recent	5	6	1	8	20	14
	Remote	4	..	..	3	7	5
Total.....	Recent	22	17	2	16	57	15
	Remote	9	..	..	15	24	6

ably representing "Cushing-like ulcers." The inset graph in Figure 2 compares the curve of acute versus chronic lesions. Besides the difference in the first few decades already noted, the "chronic" curve is broader during the period of fifty to eighty years, the flat peak extending over a greater interval of years than that seen in acute ulcers. A higher incidence of acute lesions was also seen in those patients over eighty years of age. The high geriatric rate of cerebral thrombosis and other chronic debilitating diseases might well explain this finding. All in all, fifty-five (7 per cent) of all ulcers occurred in the aged, despite the reported high incidence of achlorhydria in this age group.

The average age at death for all patients with ulcers was fifty-six years. Only stomal ulcer, with an average age at death of sixty-two, deviated from this figure. As peptic ulcer is seen clinically a decade or more earlier, it must be remembered that the data presented here come from autopsy material and do not consider the age at which the ulcer became clinically or roentgenologically demonstrable; nor does it include the lesion seen by the physician which may have healed prior to the patient's death, leaving only minimal scarring.

Surgical History. Referring to Table v, "recent" surgery was that performed within six months of the patient's death, while procedures more than six months before death were included as "remote." The figures shown in the recent and remote groups are not additive, as some of the patients in the former column had had prior gastric surgery.

Although partial gastrectomy combined with vagotomy is currently the operation of choice at University Hospital, it must be remembered that this survey covered an eighteen-year period and all hospitals within the community.

It is of interest that approximately 15 per cent of all patients coming to autopsy with chronic gastroduodenal ulcer had had some form of gastric surgery six months or less before death.

Cause of Death. Of the 374 patients with chronic gastroduodenal ulcer, 180 (48 per cent) died as a direct consequence of their acid-peptic disease. (Table VI.) Of these, eight (2 per cent) had duodenal obstruction, 100 (26 per cent) had free perforation with generalized peritonitis and seventy-two (20 per cent) suffered fatal gastrointestinal hemorrhage. A similar study showed a total mortality rate of 35 per cent: 4 per cent from obstruction, 20 per cent from perforation, and 11 per cent from hemorrhage [35]. Another found that perforation accounted for 32 per cent and hemorrhage for 15 per cent of the deaths [17]. Chiesman [6] reported that gross hemorrhage was responsible for 25 per cent of his fatal cases. It must be stressed that these data do not imply that 30 to 50 per cent of those patients in whom the diagnosis of peptic ulcer is made will die of their ulcer. Rather, they show conclusively that almost one-half of those coming to autopsy with a chronic ulcer died because of that ulcer.

In contrast to the findings in chronic ulceration, ulcer proved fatal in only 23 per cent of acute duodenal lesions and 14 per cent of acute gastric ulcers. This is reasonable since acute

TABLE VI

INCIDENCE OF ULCER-CAUSED DEATHS IN 812 PATIENTS WITH GASTRODUODENAL ULCERATION AT POSTMORTEM EXAMINATION

Type of Ulcer	Obstruction		Perforation		Hemorrhage		Total	
	No.	%	No.	%	No.	%	No.	%
Acute duodenal	0	...	20	12.7	16	10.2	36	22.9 of 157
Chronic duodenal	6	2.6	62	26.8	48	20.7	116	50.0 of 232
Acute gastric	0	...	12	5.2	20	8.7	32	13.9 of 230
Chronic gastric	2	1.4	38	26.8	24	16.9	64	45.0 of 142
Stomal	0	...	1	14.3	1	14.3	2	28.6 of 7
Acute duodenal and gastric	0	...	0	....	5	23.8	5	23.8 of 21
Chronic duodenal and gastric	1	4.3	9	39.0	4	17.4	14	60.7 of 23
Total	9	1.1	142	17.4	118	14.5	269	33.1 of 812

ulceration often represents late or terminal manifestations of many debilitating and fatal diseases where death is due mainly to the primary disease.

Because of the high incidence of ulcer-related deaths in the chronic lesion, far higher than that usually considered by the clinician, it was wondered whether this mortality varied at different age levels. Several investigators have stated that ulcer is more fatal in older age groups [7,26]. In the present series it was found that 16 per cent of those patients dying before the age of twenty died because of their ulcer, while of those who died at the age of fifty, 37 per cent represented ulcer fatalities.

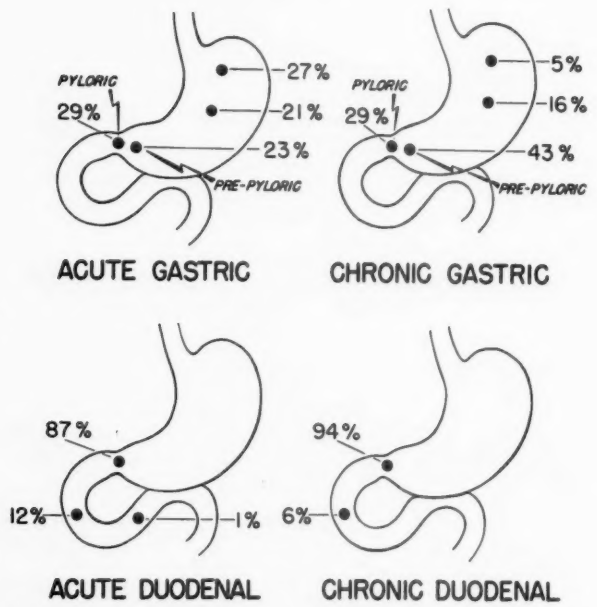


FIG. 3. Diagrammatic representation of location of ulcer. Postbulbar ulcerations were found in 13 per cent of acute and 6 per cent of chronic lesions.

Number of Ulcerations. It is of significance that almost 20 per cent of the *chronic* ulcers were multiple showing two or more distinct craters, and one in twenty patients had four or more discrete lesions.

As might be expected, more than half of acute gastric and one-fourth of the acute duodenal ulcers showed four or more craters, the principle of the multiplicity of acute ulcers being substantiated by this study.

Size of Ulcer Craters. Approximately one-half of the acute lesions were less than 1 cm. in diameter, the average of all acute ulcers being 1.4 cm. Chronic ulcers were larger; the average duodenal ulcer was 1.7 cm. in diameter, while in the stomach they measured 2.4 cm. Ninety-five (14 per cent) of all lesions, sixty of them chronic, were greater than 3.0 cm. in diameter.

Location of Ulcer. The location of these lesions as found at autopsy are represented diagrammatically in Figure 3.

It will be noted that 6 per cent of chronic and 13 per cent of acute duodenal ulcers occurred distal to the first portion. Although ulcers occurring in other than the first part are uncommon, especially those of the chronic type, the 6 per cent reported here closely parallels the 5 per cent incidence reported elsewhere [35] and supports the statement by Rauch [36], who reviewed fourteen such cases

seen clinically at The Ohio State University Health Center, that the lesion in this location is by no means a rarity.

Unfortunately, information as to the exact location of duodenal lesions was obtainable in only 40 per cent of cases. However, in the available data, 85 per cent occurred on either the anterior or posterior walls, the posterior lesion being twice as frequent. Of forty-six anterior ulcers, thirty-seven were responsible for the patient's death, thirty-five (76 per cent of forty-six) by perforation and two by hemorrhage. This incidence of perforation in anterior lesions is almost identical to that of 70 per cent as reported by DeBakey [9]. In eighty-seven posterior ulcers there were seventeen perforations (20 per cent of eighty-seven) as compared with DeBakey's incidence of 13 per cent, twelve cases of massive hemorrhage and two patients who died secondary to duodenal obstruction, or a total of thirty-one ulcer-caused deaths. Thus it is apparent that while posterior lesions were twice as common, they were approximately one-half as fatal.

Sixty-six per cent of all gastric ulcers were found in the prepyloric or pyloric area. Acute ulcers were found commonly in the fundus (27 per cent); chronic ulcers were rare (5 per cent) in this location. More detailed information disclosed that 41 per cent of the craters were on the lesser curvature and 19 per cent on the greater curvature, the remaining lesions being equally distributed on the anterior and posterior walls. The ratio of lesser to greater curvature was 1.5:1 in acute ulcers and 3.2:1 in chronic ulcers. This evidence substantiates the clinical impression that chronic gastric ulcers most often occur along the lesser curvature within 5 cm. of the pyloric ring. The majority of acute ulcers were seen in the same location.

ASSOCIATED GASTROINTESTINAL DISEASE

Esophagus. Twenty-five patients (3.1 per cent) had peptic ulcers of the esophagus in addition to gastroduodenal ulcerations. This figure closely approximates current estimates that about 4 per cent of all peptic ulcers are found in the esophagus [34]. In addition, there were sixty-seven cases of esophagitis, most of which were associated with acute gastroduodenal ulcer, and seventeen with a diagnosis of leukoplakia, although the latter is a very common finding in the lower third of the esophagus [5]. All told, ninety-two of the 812 cases, or more than one of ten, had some evidence of acid-peptic disease of the esophagus.

Gastric. It has been stated that "some degree of gastritis is almost always present in gastric and duodenal ulcer" [5], but that it is much more common in gastric ulcer [1]. In this series only 1.1 per cent of all ulcers were associated with hypertrophic gastritis. Of even more interest, atrophic gastritis, despite its resulting achylia, was seen in seven duodenal ulcers.

The absence of gastric carcinoma in patients with duodenal ulcer substantiates the belief by most clinicians that this cancer is rarely seen in the presence of active duodenal ulcer.

Duodenal. The only findings of interest were the 1.7 per cent incidence of duodenal diverticula, and a single case of benign duodenal carcinoid, clinically unsuspected, associated with an acute gastric ulcer.

Jejunum and Ileum. Disease of the small intestine proved to be extremely uncommon in this series. Of eight jejunal ulcers, seven were stomal and have been included under this heading, and one was associated with a chronic gastric perforated ulcer with massive peritonitis, gas gangrene and overwhelming shock. In this one instance of primary nonspecific jejunal ulceration there was no associated disease of the pancreatic islets.

Colon. Diverticulosis has been reported to be present at autopsy in 6 per cent of patients over fifty years of age [1]. In the 812 patients with gastroduodenal ulcer seen at autopsy there were forty-five cases of diverticulosis, an incidence of 5.5 per cent. Only six of these were complicated by diverticulitis. Other large bowel disease included eleven cases of carcinoma and nine cases in which there was clinical and postmortem evidence of idiopathic ulcerative colitis.

Pancreas (Acini). There were fifty-two cases of pancreatitis; these most often represented posterior gastroduodenal perforations into the pancreas. In addition, ten patients had adenocarcinoma of the pancreatic acini. Pseudocysts were found in five patients. The distribution of these lesions among the various types of ulcer was such that no pattern could be elicited. Islet cell disease will be included under associated endocrine disease.

TABLE VII

ASSOCIATED CENTRAL NERVOUS SYSTEM DISEASE IN 761 PATIENTS FOUND TO HAVE GASTRODUODENAL ULCERATION AT AUTOPSY

Type of Ulcer	Cerebral Edema	Cerebral Thrombosis	Cerebral Hemorrhage	Meningitis	Tumor	Bulbar Poliomyelitis	Meningeal* Hemorrhage	Total	
								No.	%
Acute (387).....	36	19	19	19	12	9	29	143	37
Chronic (374).....	9	4	6	2	2	0	4	27	7
Total (761)†.....	45	23	25	21	14	9	33	170	22

* Includes epidural, subdural and subarachnoid hemorrhage.
† Permission for postmortem examination of the head obtained in only 761 of 812 cases.

ASSOCIATED CENTRAL NERVOUS SYSTEM DISEASE

As shown in Table VII, concomitant central nervous system disease was seen in 37 per cent of 387 patients with acute ulcers, and 7 per cent of 374 patients with chronic ulcers. With each type of neurologic lesion, acute ulcer was far more frequent than chronic ulcer.

In 1932 Cushing [*8*] revived the theory first advanced by Rokitansky concerning the neurogenic etiology of acid-peptic disease, when he reported the occurrence of acute gastroduodenal ulceration following various neurosurgical procedures, usually those involving tumors of the posterior fossa. He also included in his paper two cases of ulcer associated with malignant hypertension, and one chronic ulcer, the latter complicating a radiosensitive intracranial neoplasm. This ulcer regressed following radiation to the tumor and reappeared when the tumor recurred. Cushing postulated that these intracranial lesions, especially those occurring in the region of the hypothalamus, acted either by direct stimulation of vagal centers or inhibition of sympathetic nuclei, the end result being increased parasympathetic activity. This would lead to increased gastric motility and tonicity, the rise in tonus being greatest at the pylorus. Cushing suggested that the net effect of this altered physiology was local ischemia of the gastroduodenal mucosa and subsequent ulceration.

Further support for the role of the neurological lesion was supplied by evidence that the incidence of gastric ulcer at autopsy was higher in patients with arteriosclerotic brain disease than that found in the general population [*33*].

Schlumberger [*41*] has previously reported ten "Cushing-like" ulcers, included in this series, which were seen in autopsies on eighty-nine children with lesions of the central nervous system. The associated brain disease included cerebral hemorrhage (one case), tuberculosis meningitis (three cases), cerebral edema (two cases), bulbar poliomyelitis (two cases), congenital anomalies (one case) and sinus thrombosis (one case). All the ulcers were acute; seven were duodenal. The author cites the finding of foci of degeneration in the supraoptic and paraventricular ganglions of the hypothalamus and in the ganglion nodosum of the vagus in four cases of chronic gastric ulcer. Schlumberger agreed that the increased parasympathetic activity hypothesized by Cushing might well result in the initial gastroduodenal ulceration. Furthermore, he postulated that neurosecretory cells present in the hypothalamus are stimulated by the same lesions in neighboring brain tissue leading to an increased production of ACTH and in turn increased adrenal activity. The excessive corticosteroids were then postulated to interfere with the healing of the ulcer. (Fig. 4.) This view somewhat reconciles the "neurogenic theory" of Cushing with Selye's contention that acute ulcers are a part of the "adaptation syndrome" [*42*] and finally, it may substantiate the mechanisms reported by Gray et al. [*22*]. In reviewing the cases described by Cushing, there is little doubt that many of these patients were in frank or impending

shock and that stress may have played an important role in the production of the "Cushing ulcer."

A comprehensive discussion of this subject is that presented by Ivy et al. [27]. Although they agree that the occurrence of acute gastroduodenal ulcer in association with intracranial disease is a well established principle, they were unable to find sufficient evidence that these lesions depended on a disturbance in the hypothalamus as proposed by Cushing, or that experimental brain lesions were capable of producing histologically chronic ulcers. In support of the concept that neurological disease can produce ulcerations in other than the stomach and duodenum, they cite the report of Keller [30] who described buccal mucosal and gastroduodenal ulcerations following experimental brain stem lesions in dogs, the ulcers in both areas developing and healing in a similar manner despite the fact that gastric secretion has no influence on the oral lesions.

It is apparent that the relationship between acid-peptic disease and lesions of the central nervous system is far from solved. In fact, in the presence of intracranial disease, it is often impossible to distinguish the "Cushing ulcer" from the so-called "stress ulcer."

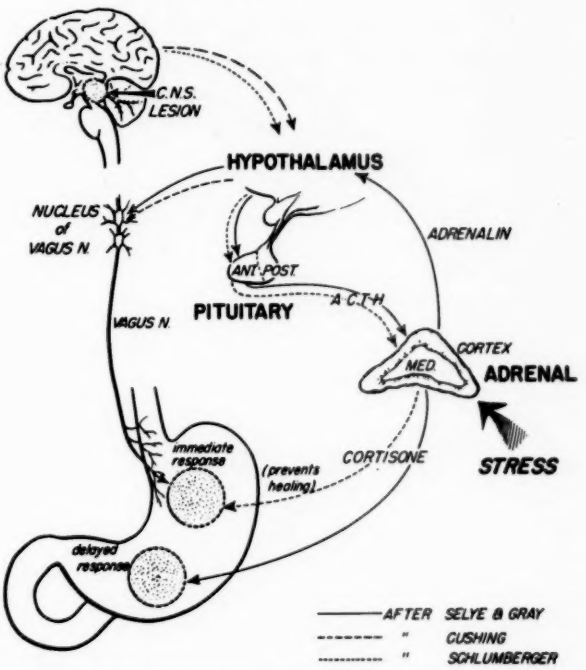


FIG. 4. Diagrammatic representation of the possible influence of the endocrine and nervous systems on gastric function and peptic ulcer. The unbroken line depicts the mechanism suggested by Selye and supported by Gray and his associates. Cushing's original hypothesis is shown by the broken line, while the dotted line represents the mechanism postulated by Schlumberger to explain the role of the adrenal in the etiology of chronic acid-peptic disease.

ASSOCIATED ENDOCRINE DISEASE

An entity consisting of multiple endocrine adenomas has recently been reported by several investigators [45,48]. Four of their cases associated with intractable peptic ulceration have been reviewed in a recent collection of ulcerogenic islet cell adenomas [11]. In our series of 812 patients with acid-peptic disease, however, none was found to have lesions of more than one endocrine gland.

Diabetes. It has long been thought by clinicians that diabetes "protects" against ulcer, and there have been several reports in the literature on the infrequency of acid-peptic disease in the diabetic patient. Wood [53] found only ninety-four ulcers (0.78 per cent) in 12,000 diabetic patients, and Rothenberg and Teicher [38] reported a 0.25 per cent incidence of ulcers in 3,525 patients with diabetes. It has been noted, however, that as ulcer is seen ten to twenty years earlier than is diabetes, the apparent decreased incidence may be artifact [29]. Ivy et al. [27] quote statistics showing an increased frequency of achlorhydria in diabetic patients and definitely believe that the diabetic patient is *not more* susceptible to acid-peptic disease than the non-diabetic patient.

TABLE VIII
INCIDENCE OF DIABETES MELLITUS IN 812 PATIENTS WITH ACID-PEPTIC DISEASE AT AUTOPSY

Type of Ulcer	Incidence of Diabetes	
	No.	%
Acute duodenal (157)	17	10.8
Chronic duodenal (232)	5	2.2
Acute gastric (230)	9	3.9
Chronic gastric (142)	3	2.1
Stomal	0	....
Acute duodenal and gastric (21)	3	14.3
Chronic duodenal and gastric (23)	0	....
Total (812)	37	4.6

The percentage of the general population

affected with diabetes has been estimated by Joslin et al. [29] to be approximately 1.5 per cent; 1 per cent have "known" diabetes while an additional 0.5 per cent have undiagnosed disease.

The postmortem incidence of this disease at The Ohio State University was 2.5 per cent (500 cases) in the same 20,000 autopsies studied in this report. Therefore it was surprising to find the incidence of diabetes in patients with peptic ulcer to be 4.6 per cent, a statistically significant increase.* (Table VIII.) Of the 500 cases of diabetes in 20,000 autopsies, thirty-seven (7.4 per cent) had associated gastroduodenal ulcer. This figure is somewhat higher than the 3.7 per cent incidence of ulcer seen in diabetic patients at postmortem examination at Boston City Hospital, or the 2.3 per cent incidence seen at Peter Bent Brigham Hospital [29].

It should be noted that it is the acute duodenal ulcer with a diabetic incidence of 10.8 per cent that contributes to the over-all increase. But even disregarding this lesion, the incidence of diabetes in ulcer patients at autopsy is equal to or greater than that of the general population.

Pituitary. Wilson et al. [51], in their review of 512 pituitary tumors, found only five patients (1 per cent) with peptic ulcer, although Winkelstein [52] has reported a close correlation between hypophyseal dysfunction and duodenal ulcer in adolescent boys. In the present study there was one case each of eosinophilic adenoma, basophilic adenoma and chromophobe adenoma, and six patients were noted to have evidence of cellular hyperplasia, four with "basophilia" and two with "eosinophilia." This paucity of hypophyseal lesions lends support to the conclusions of other investigators that peptic ulcer is not associated with primary anterior pituitary disease [40] and suggests that the ulcer diathesis found in multiple endocrine adenomas may be secondary to dysfunction of some other endocrine gland. The role of the pituitary in the hypothalamus-pituitary-adrenal axis will be discussed with adrenal disease.

Thyroid. Of thirty-one patients found to have colloid goiter, twenty-three had nodular goiter and eight diffuse; seven of the eight diffuse goiters were complicated by acute gastroduodenal ulcer. The relation of thyroid disease to peptic ulcer and the one example of thyrotoxicosis seen in this series have recently been reviewed by Ellison and Abrams [12], who concluded that on the basis of current knowledge, the thyroid hormone plays no important role in the etiology of acid-peptic disease.

Parathyroid. The role of this ductless organ in peptic ulceration has often been questioned. Hyperparathyroidism may itself produce symptoms similar to those of duodenal ulcer [24], and one investigator reported that 24 per cent of patients with proved hyperparathyroidism had, at the time of examination or in the past, objective evidence of peptic ulcer [3]. Yet only six of 812 patients (0.7 per cent) had demonstrable parathyroid disease. Five of these cases were diagnosed microscopically as hyperplastic and the remaining case showed metastatic carcinoma. None of these lesions produced clinical evidence of altered parathyroid physiology.

Islets of Langerhans. Five cases of non-beta cell adenoma, the "ulcerogenic tumor of the pancreas," discovered in this survey have previously been reported by one of the authors [11]. Twenty-six additional instances of islet disease, including three adenomas, two islet cell carcinomas and two cases of islet cell hyperplasia, are currently being investigated to determine the clinical significance of these postmortem findings. No examples of functioning beta cell adenoma with hyperinsulinism associated with peptic ulcer were found.

Adrenals. The incidence of hyperplastic lesions of the adrenal gland seen in this review of 812 patients with acid-peptic disease varied between 8.7 and 15.9 per cent depending on the type of ulcer and averaged 13.2 per cent

* Assume that 2.5 per cent is the true autopsy incidence ($\bar{p}$)

$$\text{then: S.D.}_{\bar{p}} = \sqrt{\frac{(0.025)(0.975)}{182}} = 0.005 = 0.5\% = 1 \text{ standard deviation}$$

but: the difference between the incidence in 812 ulcer patients and that found in 20,000 autopsies is $4.6\% - 2.5\% = 2.1\%$

therefore: the ulcer incidence of diabetes is more than 4 standard deviations greater than that found in 20,000 autopsies; thus there is a 99 per cent probability that patients with peptic ulcer have a higher incidence of diabetes than the general population at postmortem examination.

Also, these data show X^2 to be greater than 10, a highly significant value.

TABLE IX

ASSOCIATED ADRENAL DISEASE IN 812 PATIENTS WITH ACID-PEPTIC DISEASE AT AUTOPSY

Type of Ulcer	Hyperplasia*		Unilateral Adenoma		Carcinoma	
	No.	%	No.	%	No.	%
Acute duodenal (157)	25	15.9	4	2.5	1	0.6
Chronic duodenal (232)	28	12.1	9	3.9	1	0.4
Acute gastric (230)	20	8.7	8	3.5	0	...
Chronic gastric (142)	20	14.1	4	2.8	0	...
Stomal (7)	1	14.3	0	...	0	...
Acute duodenal and gastric (21)	3	14.3	0	...	0	...
Chronic duodenal and gastric (23)	10	43.5	0	...	0	...
Total (812)	107	13.2	25	3.1	2	0.2

* Includes nodular hyperplasia, cortical hyperplasia and bilateral adenomas.

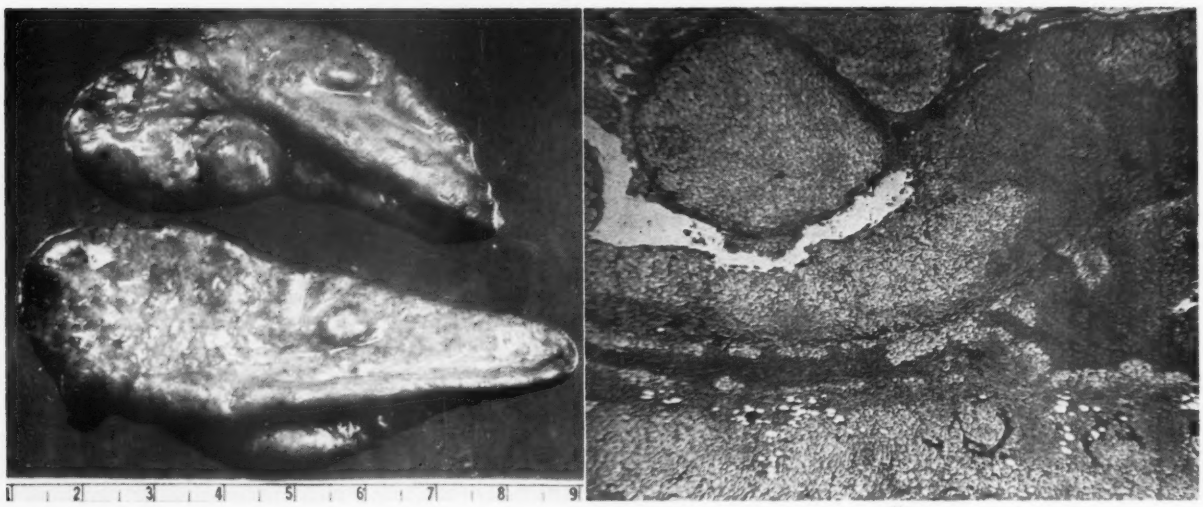
for the entire series. (Table IX.) This was more than double the 5.6 per cent of adrenal hyperplasia found in the total 20,000 autopsies.* Unilateral adenomas were found in 3.1 per cent of the ulcer patients as compared with 2.3 per cent of the 20,000 archives.

In our institution the hyperplastic adrenal lesions include: (1) nodular hyperplasia, (2) cortical hyperplasia and (3) bilateral adenomas. The diagnosis is based on the finding of increased weight of the combined glands (normal, less than 12 gm.), gross thickening of the cortex and the microscopic appearance of marked hyperplasia of the cortical zone, either generalized or modular, with an increased amount of lipid material. (Fig. 5.) Medullary hyperplasia, when found, is considered a distinct and separate entity.

Pathologists have generally considered that the finding of adrenal hyperplasia and adenoma at autopsy had little significance, and that there is no correlation between the microscopic picture of hyperplasia and the *in vivo* activity of the adrenal [1]. The solitary adenoma is definitely thought to be functionless. In certain cases, e.g., the adrenogenital syndrome or Cushing's disease, adrenal hyperplasia can produce clinical disease, but in the majority of instances it is impossible to relate the postmortem finding of this lesion with any clinical evidence of hyperadrenalism. In their series of 9,000 autopsies Russi and Blumenthal [39] found a total incidence of adrenal adenomas and hyperplasia of 1.45 per cent, a figure well below that found in the current study. However, they did report that 16 per cent of their patients with adrenal adenomas had diabetes (3 per cent had diabetes in the series of 9,000) while 7.4 per cent of those with hypertension had adrenal lesions. It is currently believed that adrenal nodules or adenomas can be found in approximately 10 per cent of patients with either diabetes or hypertension.

Gray and his associates [19–22] have recently studied the effect of ACTH and adrenal cortical hormones on gastric function. They reported that the administration of these drugs in both the normal animal and human produced an increase in the gastric secretion of HCl and pepsin and a rise in the excretion of uropepsin, these values often equalling those found in patients with active duodenal ulcer. Other investigators have reported similar results [16], even postvagotomy. Because adrenal steroids, specifically compounds B and F, and their analogues, e.g., prednisone, can influence gastric secretion following the complete division of the vagi as measured by insulin hypoglycemia, it has been suggested that these steroids act *directly* on the gastric cell. It has also been shown that acute physical stress results in greater acid secretion and uropepsin excretion accompanied by a fall in circulating eosinophils and a rise in urinary ketosteroids [22]. Dragstedt [10], in his own studies, has failed to substantiate these findings, and questions the influence of adrenal

* The figure of 5.6 per cent is based on screening every twentieth archive of the 20,000 included in this report.



5A 5B

FIG. 5. Criteria used for the diagnosis of nodular hyperplasia of the adrenal cortex. A, gross specimen showing nodularity and thickening of the cortex. The medulla is normal. B, high power photomicrograph of (A). Note the marked thickening of the zona reticularis and fasciculata and the increase in intracellular lipoid material. Hematoxylin-eosin stain.

steroids on the stomach, since following vagotomy gastric secretion falls markedly despite the increased adrenal activity stimulated by the stress of surgery. A similar view was adopted by Friedman and Sandweiss [*15*], who found that the gastric hyposecretion of Mann-Williamson dogs could be restored to normal with ACTH, but that they were unable to achieve greater-than-normal secretion. However, adrenalectomy in a pylorus-ligated rat produces a significant hypoacidity and hyposecretion which is restored to normal by cortisone [*46*].

The practicing physician is well aware of the complication of gastroduodenal ulcer and perforation in patients who have been on continual therapy with large doses of adrenal steroids, and the danger of using these agents in a patient with known acid-peptic disease. It is also noteworthy that it has been reported that uropepsin values are increased in patients with Cushing's syndrome and markedly decreased in those with Addison's disease [*21*].

It is an accepted principle that chronic ulcer is a rarity in persons with Addison's disease [*28,32*], although peptic ulcer has occurred following treatment of these persons with adrenal steroids. Gray and his associates [*19–22*] have offered the following hypothesis: Stress, via the hypothalamus, stimulates the anterior pituitary gland to secrete ACTH which, through its effect on the adrenal, leads to the release of adrenal corticoids. (Fig. 4.) Normally the stomach enjoys a semi-autonomous relationship with the adrenal, a theory formulated by Selye [*43*], but under conditions of stress it falls under the direct control of the adrenal cortex, a situation that Selye has called "permissive-conditioned." Stress affects the stomach in two ways: (1) hypothalamus → vagus → gastric hypersecretion, *immediate;* and (2) hypothalamus → anterior pituitary → adrenal cortex → gastric hypersecretion, *delayed*, this latter occurring in the absence of vagal stimulation. Thus, in stress, the increased release of adrenal corticoids leads to greater gastric secretion which can be determined by measuring excreted uropepsin.

These are fascinating studies which hold great promise for a better understanding of the role of the adrenal gland on gastric function. Suffice it to say, it has been clearly shown in the present study that the incidence of adrenal hyperplasia in patients with acid-peptic disease, both acute and chronic, is at least as high as that reported in hypertension and diabetes; this suggests that the relationship between this lesion and peptic ulcer may be more than just coincidence.

SUMMARY AND CONCLUSIONS

1. In a review of 20,000 consecutive autopsies, 812 active gastroduodenal ulcers were found, an incidence of 4.1 per cent. Acute ulceration proved to be one and a half times

more common in the stomach, whereas chronic lesions occurred more frequently in the duodenum by a ratio of 1.7:1. The incidence of peptic ulceration in the Caucasian and the Negro was identical in this series. Of 374 chronic ulcers, gastric lesions were two and a half times and duodenal ulcers three and a half times more common in the male. Chronic acid-peptic disease was only rarely seen in patients under the age of thirty years, while almost 20 per cent of acute lesions occurred in patients in the first three decades of life.

2. One of five, or 20 per cent, of all chronic ulcers was multiple, and six of every hundred patients with chronic ulceration at autopsy had lesions of both the stomach and duodenum. The majority of gastric ulcers, acute and chronic, were found on the lesser curvature within 5 cm. of the pyloric ring, and 6 per cent of the chronic duodenal lesions were located in the second portion of the duodenum.

3. Approximately 15 per cent of all patients coming to autopsy with chronic gastroduodenal ulcer had undergone some type of gastric surgery within six months of their death.

4. Of those patients with chronic ulcer, 48 per cent died as a direct consequence of their acid-peptic disease, hemorrhage and peritonitis being primarily responsible for death. Ulcer was twice as fatal in those patients fifty years of age or over than in those under the age of twenty years. Although chronic posterior duodenal lesions were twice as common as those found on the anterior wall, they were, as might be expected, approximately one-half as fatal.

5. The incidence of diabetes mellitus in ulcer patients at autopsy was equal to or greater than that of the entire series or even that reported for the general population, suggesting that, contrary to common belief, diabetes does not "protect" against acid-peptic ulceration.

6. Nearly one of ten patients with gastroduodenal ulcer had associated acid-peptic disease of the esophagus, a fact not commonly regarded by the clinical surgeon.

7. Concomitant central nervous system disease was found in 37 per cent of the patients with acute gastroduodenal ulcers and only 7 per cent of the patients with chronic lesions. The mechanism of these "Cushing-like" ulcerations and their possible relationship to the "stress" ulcer has been discussed.

8. The paucity of associated disease in the pituitary, the thyroid and the parathyroids suggests that dysfunction of these endocrine organs probably plays little or no role in the pathogenesis of peptic ulcer.

9. Twenty-six instances of islet cell abnormality, including three benign adenomas, two malignant tumors and two examples of extreme islet cell hyperplasia, were found and give added support to the suggestion that the non-beta islet cells of the pancreas may be of significance in patients with intractable acid-peptic disease. These cases will be reported in detail in a later publication.

10. The incidence of adrenal cortical hyperplasia was 13.2 per cent in the 812 ulcer patients, an occurrence twice that seen in the entire series of 20,000 autopsies and equal to or greater than that reportedly found in hypertension or diabetes. This finding gives additional weight to Gray's hypothesis that the adrenal gland is related to gastric secretion and plays an important role in the etiology of acid-peptic disease.

There were many points of interest in this review, each fully worth continued study. Unfortunately, a discussion of all of these items would require a manuscript of textbook proportions. Therefore only the findings are presented and questions posed on facets of this material which demand further consideration.

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Survival of Female Patients with Cancer of the Breast

A STUDY OF THE EFFECTS OF DEMOGRAPHIC AND ECONOMIC FACTORS

BRUCE D. WAXMAN, M.A., *Hartford, Connecticut,* AND WILLIAM T. FITTS, JR., M.D., *Philadelphia, Pennsylvania*

From The Department of Surgery, Hospital of the University of Pennsylvania; and The Harrison Department of Surgical Research, School of Medicine of the University of Pennsylvania, Philadelphia, Pennsylvania.

IN recent years several public agencies, e.g., the American Cancer Society and the Public Health Service, have conducted intensive campaigns to educate the public in cancer detection. Despite concern that this knowledge might create a widespread fear of the disease, the agencies have hoped that early detection would increase survival and outweigh the cancer phobia of the layman which might result [1].

It is important to determine what effect, if any, early detection of symptoms has on survival, and if demographic and economic factors may be important. To elucidate these factors we have studied the effect of demographic factors (age, marital status and race) which might prolong the time before symptoms are reported and thereby affect survival time. In addition, we have studied the relationship between economic status and survival through the use of certain economic indices.

DATA

The data analyzed were obtained from the records of patients treated at the Hospital of the University of Pennsylvania. Records of 740 patients admitted consecutively with cancer of the breast were collected from the files of the Department of Surgery. The 740 records describe all the patients with cancer of the breast who were treated at the hospital for the years 1943 to 1951. From these, 633 patients were selected because they met the following criteria: (1) they must be female; (2) they must have been treated primarily at the Hospital of the University of Pennsylvania; (3) they must have a pathological diagnosis of cancer of the breast.

After the records had been screened and abstracted to determine whether the aforementioned criteria had been satisfied, a follow up was undertaken to ascertain the state of health of every patient as of December 31, 1954.

The patients were followed up by three methods: (1) If ambulatory and available for examination, the patient was asked to return to the hospital for examination by her own physician if she had been a private patient, or for examination in the Tumor Clinic if she had been a ward patient. (2) If a patient could not come to the hospital her condition was ascertained by correspondence with the patient's family physician. (3) Data concerning six patients were obtained by telephone conversation. In all instances, if the patient had died, the date and cause of death were determined. As indicated in Table 1, adequate information was obtained for all except 3 per cent of the patients.

Because no attempt was made to select a sample of patients with cancer of the breast on any basis other than that they were treated at the Hospital of the University of Pennsylvania, the demographic characteristics of the sample do not necessarily correspond to those of the population at large with this condition. The mean age of the patients in this series was 53.7 years. A comparison with other series of cases of cancer of the breast indicates that the mean age of this series is consistent with findings reported by others [2,3]. A break-

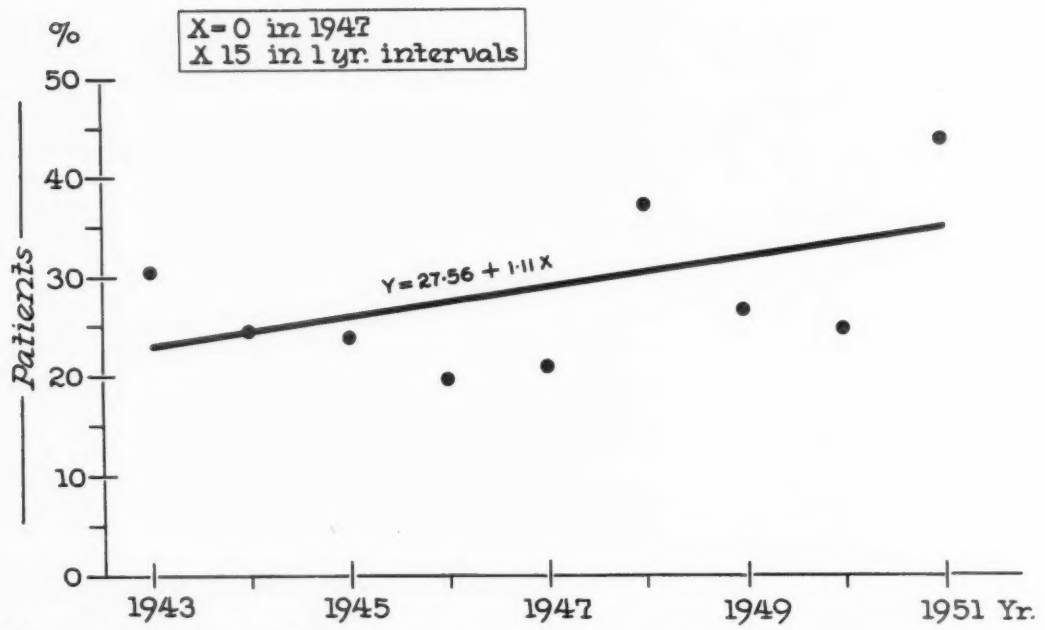

FIG. 1. Percentage of female patients with cancer of the breast who had symptoms of under one month's duration.

down of marital status revealed that 67 per cent were married, 16 per cent widowed, 13 per cent were single and 3 per cent were divorced. The racial composition of the sample was 83 per cent white and 17 per cent Negro.

Because the price of the bed occupied by the patient while in the hospital is an indication of his economic status, a rough estimate of the sample is possible. Thirty-six per cent of the sample were ward patients, 46 per cent occupied semi-private rooms and 18 per cent were in private rooms. As will be pointed out in another section of this paper, the type of room patients occupy in a hospital is probably a good index of their economic position.

DEMOGRAPHIC FACTORS AND THE DURATION OF SYMPTOMS

The scatter diagram (Fig. 1) indicates the proportion of patients for each year between 1943 and 1951 whose duration of symptoms* was under one month when first treated. The trend line which has been fitted to the scatter of Figure 1 shows a definite increase in the proportion of patients who report symptoms early. This trend toward earlier reporting of symptoms is probably the result of increasing publicity about cancer.

Because it is generally believed that people should report cancer symptoms early and also that publicity about cancer should reach the lower economic strata where low incomes are probably a deterrent to the immediate reporting of symptoms, the series was analyzed to determine whether there had been any significant increase in the percentage of female ward patients with cancer of the breast in the hospital over the years, and also whether there was a significant reduction in the duration of symptoms of these ward patients. The results of this analysis are reported in Table II. Clearly the number of ward patients treated in the period 1947 to 1951 was more than twice that of the earlier period. On the other hand, this increase in the number of ward patients is not proportionately much greater than the total increase in the number of patients treated at the hospital over the same two periods.* With respect to the decreased

* The term "duration of symptoms" refers to the length of time between the patient's first awareness of her symptoms and the time she was treated in the hospital. It should be noted that the "duration of symptoms," as we have defined this term, is only a rough estimate of the length of time that the patient had the disease. It is quite probable that cancer was present long before the symptoms were noted.

* One hundred ninety-nine patients were treated in the period 1943 to 1946 and 434 in the period 1947 to 1951. This is an 118 per cent increase. Data in Table II show that ward patients only increased 126 per cent over the two periods.

TABLE I
PERCENTAGE OF PATIENTS FOLLOWED UP (1943 TO 1951)

Year	No. of Patients	Per cent Followed Up
1943	36	97
1944	33	91
1945	63	95
1946	67	99
1947	63	97
1948	89	97
1949	95	96
1950	89	98
1951	98	98
Total.....	633	97

TABLE II
YEAR SEEN AND DURATION OF SYMPTOMS IN FEMALE WARD PATIENTS

Years	Total No. of Ward Patients	No. of Ward Patients with Symptoms of Under One Month's Duration	Per cent of Ward Patients with Symptoms of Under One Month's Duration
1943 to 1946	70	7	10
1947 to 1951	158	40	25
Total.....	228	47	21

TABLE III
RACE AND DURATION OF SYMPTOMS

Race	No. of Patients	Duration of Symptoms Under One Month (No.)	Duration of Symptoms Under One Month (%)
White.....	523	157	30.0
Negro.....	110	24	21.8
Total.....	633	181	28.5

TABLE IV
TYPE OF ROOM OCCUPIED AND DURATION OF SYMPTOMS

Type of Room	No. of Patients	Duration of Symptoms Under One Month (No.)	Duration of Symptoms Under One Month (%)
Ward.....	228	47	20.6
Semi-private....	289	92	31.8
Private.....	116	42	36.2
Total.....	633	181	28.5

duration of symptoms over the two periods, a considerably higher proportion of ward patients (25 per cent) had a duration of symptoms under one month in the later period than in the earlier one (10 per cent). This difference is significant at the .05 level when tested by chi-square. These data indicate that publicity about cancer is having a significant effect in reducing the duration of symptoms for the lower economic strata.*

Table III offers a tabulation of the duration of symptoms by race. While the proportion of white persons who had a duration of symptoms under one month was higher than the proportion of Negroes, the difference was not statistically significant,* at the .05 level.

When the relationship between economic status, as measured by the type of room occupied, and the duration of symptoms is analyzed, striking differences appear. (Table IV.) While only 20.6 per cent of the ward patients reported their symptoms within one month, 36.2 per cent of the private patients reported their symptoms early. There seems to be little question that economic status is related to the duration of symptoms. The difference is significant at the .01 level.

* It is possible that the records show a decrease in delay in treatment because physicians are becoming more alert to this problem. It is possible that whereas a physician might previously have written "two months" if a patient reported symptoms for six weeks, later on he might have written six weeks exactly because he had become aware that early reporting of symptoms might influence survival.

* The minimum level of significance accepted throughout this paper was .05. The chi-square test performed on the data in Table III yielded a value significant at the .10 level. Evidence presented in other parts of this report (Tables IV and VIII) suggests that there may be good reason for accepting a more liberal level of significance.

TABLE V
COMPARISON BETWEEN HOSPITAL ROOM AND RENTAL CLASS

Type of Room Occupied	No. of Female Patients Living in Philadelphia in 1951	Patients from Blocks with Average Rent Under $40.00 per Month	
		No.	Per cent
Ward	27	19	70.1
Semi-private	24	5	20.8
Private	13	2	15.3
Total	64	26	40.6

TABLE VI
DURATION OF SYMPTOMS AND FIVE-YEAR SURVIVAL (1943–1946)

Duration of Symptoms	No. of Patients	No. Surviving Five Years	Per cent Surviving Five Years
Under 1 mo.	43	29	67.4
1–2 mo.	45	27	60.0
3–5 mo.	34	19	55.8
6–9 mo.	29	13	44.8
10 mo. plus	35	13	37.1
Unknown	5	0	0.0
Total	191	101	52.9

We selected the type of room occupied as an index of economic status because more adequate data, for example, husband's income or occupation, were not available. The validity of the room index was, however, tested by comparison with another index. On the basis of the patient's address, average monthly rental was computed from block statistics published by the Census Bureau for the City of Philadelphia [4]. For every patient who lived in the City of Philadelphia in 1951 the average monthly rent was obtained for the block in which the patient resided. It was thus possible to determine roughly the rental class of the patient, and it was assumed that rent is highly correlated with income. A comparison of the indices is given in Table v. It will be noted that 70 per cent of the ward patients were in the rental class of under $40.00 a month while only 21 per cent of the semi-private and 15 per cent of the private patients were in this class. When the difference between ward and non-ward patients was tested in terms of the number of persons living in blocks with an average rent of under $40.00 a month, a chi-square was obtained which was significant at the .001 level.

SURVIVAL AND THE DURATION OF SYMPTOMS

It is the objective of this section of the paper to demonstrate the relationship between survival and the duration of symptoms. Table VI includes the analysis of 191 females with cancer of the breast who were followed up for five years. These observations cover all patients primarily treated at the Hospital of the University of Pennsylvania between the years 1943 and 1946. Examination of Table VI shows a very definite inverse linear relationship between the duration of symptoms and survival: 67 per cent of those with a duration of symptoms under one month survived five years as opposed to 60 per cent with a duration of one month to two months, 56 per cent with a duration of three months to five months, 45 per cent with a duration of six months to nine months, and 37 per cent with a duration of ten months and over. The results of this analysis indicate that patients who report cancer symptoms early have a better chance of survival.

THE EFFECTS OF AGE, MARITAL STATUS AND RACE ON SURVIVAL

Neither age nor marital status seems to affect the chances of survival significantly in our series. There was a small difference between married persons and others, consistent with findings from other sources [5], but it was not statistically significant when based on a limited number of patients. Fifty-four per cent of the married persons survived five years while 50 per cent of the single, divorced and widowed patients survived five years.

When survival is analyzed by race (Table VII), the percentage surviving five years is much higher for white persons than Negroes. This difference is significant at the .05 level. It is quite probable that the racial difference in survival can be accounted for by the longer duration of symptoms before treatment of the Negro patients.

TABLE VII
RACE AND FIVE-YEAR SURVIVAL (1943–1946)

Race	No. of Patients	No. Surviving Five Years	Per cent Surviving Five Years
White	159	87	54.7
Negro	32	14	43.7
Total	191	101	52.9

TABLE VIII
COMPARISON BETWEEN TYPE OF ROOM OCCUPIED AND FIVE-YEAR SURVIVAL (1943–1946)

Type of Room	No. of Patients	No. Surviving Five Years	Per cent Surviving Five Years
Ward	70	32	45.7
Private and semi-private	121	69	57.0
Total	191	101	52.9

The analysis of survival by the type of room occupied (Table VIII) indicates that the proportion surviving five years is higher for the semi-private and private category than for the ward group. These differences, however, are not significant at the .05 level.*

CONCLUSIONS

1. Our data indicate that women who report symptoms of cancer of the breast early live longer than women who report symptoms later.

2. We noted a significant increase in the proportion of ward patients reporting symptoms of under one month's duration in the period 1947 to 1951 as opposed to the period 1943 to 1946. There also appears to be a general trend in the data from this series toward earlier reporting of symptoms by all patients regardless of their economic status.

3. Female patients with cancer of the breast with a duration of symptoms under one month have a better chance of survival than do patients with duration of symptoms over one month.

4. Strong evidence is presented that economic status is positively correlated with early reporting of symptoms.

5. Although we did not demonstrate a statistically significant relationship between economic status and survival when the chi-square test was employed, the persistence of differences in the same direction indicates that there are positive relationships between economic class and survival. Although the difference in the survival for the ward and non-ward patients is not significant at the .05 level, there is a considerable difference in the percentage surviving five years for these two groups. Considering all the observations (a significant difference between the duration of symptoms for ward and non-ward patients, a definite relationship between survival and the duration of symptoms, and the fact that the Negro group behaves much the same as the ward group), it appears that there may be an economic factor working indirectly on survival through a differential time lag in the reporting of symptoms.

* Here, as was the case in Table III, a more liberal level of significance could have been accepted (.10).

Acknowledgment: We are indebted to Drs. Dorothy Swaine Thomas and Everett Lee of the Department of Sociology, University of Pennsylvania, for their aid in the conduct of this study.

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Sarcoma of the Stomach

BJORN THORBJARNARSON, M.D., JOHN M. PEARCE, M.D. AND JOHN M. BEAL, M.D.,
New York, New York

From The New York Hospital-Cornell Medical Center, New York, New York.

BECAUSE sarcoma represents approximately 5 per cent of malignant neoplasms of the stomach, there have been few reports that have described experiences with more than a few cases of gastric sarcoma. These lesions are encountered infrequently and an analysis of fifty cases of malignant neoplasms of mesenchymal origin appeared justified. The patients were treated during a twenty-six-year period on the pavilion service of The New York Hospital from 1932 to 1958.

INCIDENCE

Malignant neoplasms may develop from any of the elements of the gastric wall. In the present series lymphoma predominated and accounted for thirty-seven of the total fifty sarcomas. Leiomyosarcoma was present in eleven cases and single instances of fibrosarcoma and myxosarcoma complete the series. (Table 1.) This distribution is similar to that which has been reported by others [1,5].

The ages of the patients ranged from sixteen to seventy-nine years. Malignant lymphomas occurred most frequently in persons between the ages of forty and seventy years while the other sarcomas were distributed rather uniformly among those from twenty to seventy years of age. The youngest patient in the present report was a sixteen year old boy with a leiomyosarcoma.

TABLE 1
SARCOMA OF THE STOMACH

Type	No. of Cases
Lymphoma	37
Leiomyosarcoma	11
Myxosarcoma	1
Fibrosarcoma	1
Total	50

It is apparent from the study that certain differences in clinical manifestations exist between lymphoma of the stomach and other sarcomas, and, for this reason, these two groups are considered separately.

GASTRIC LYMPHOMA

Clinical Manifestations. Pain, weight loss and bleeding were, in order of frequency, the most common symptoms. Abdominal pain was the presenting complaint in thirty-three patients (89 per cent). The pain was epigastric in thirty-one and periumbilical and generalized in one each. Pain was dull and persistant in all but five patients who reported some relief from gnawing or burning epigastric distress after the ingestion of food or alkali. Twenty-nine patients reported loss of weight prior to admission to the hospital. The amount of weight loss varied from 3 to 60 pounds and was most marked and rapid in those who had evidence of obstruction to the gastric emptying.

Evidence of gastrointestinal bleeding was found in twenty-two patients (59 per cent). Massive hemorrhage with hematemesis and melena occurred in nine patients.

The onset of symptoms was often insidious and the duration of symptoms was often difficult to establish with certainty. An example is afforded by one patient in whom lymphosarcoma of the stomach was the only lesion found and who had suffered from epigastric pain for twenty-five years. Excision of the neoplasm was followed by relief of the pain.

Physical examination revealed evidence of weight loss in the majority of the patients but usually was otherwise not of diagnostic

significance. In nine patients an epigastric mass was palpated. In the majority of these the mass was described as movable, nontender and separate from the liver. In contrast to patients with carcinoma of the stomach, resection was possible in eight of the nine patients with gastric lymphoma in whom a mass had been felt prior to operation.

Diagnostic assistance from laboratory determinations has been lacking. Hematologic studies of the peripheral blood have not demonstrated abnormal cells of the lymphoid series. Leukocytosis of more that 10,000 white blood cells per cu. mm. occurred in two patients, both of whom were found to have Hodgkin's disease of the stomach. The highest relative lymphocytosis (56 per cent) and the lowest lymphocyte count (4 per cent) were from patients with reticulum cell sarcoma. Evidence of secondary anemia was detected in nineteen patients who had hemoglobin values of less than 13 gm per cent.

Fasting free hydrochloric acid was present in only one parient in whom gastric analyses were performed. In ten patients free acid appeared in the gastric secretion after the administration of histamine and increased to levels that varied from 8 to 80 clinical units. In thirteen patients free acid was not demonstrated after histamine stimulation.

Roentgenographic examination of the upper gastrointestinal tract has been disappointing from the diagnostic standpoint. In the thirty-three patients in whom radiologic study was performed, the correct diagnosis was suggested in only four cases. In one patient the neoplasm was not demonstrated. In the remaining patients a variety of impressions was obtained, and have been tabulated. (Table II.) It may be noted that the gastric lesion was usually interpreted as carcinoma. It is perhaps more important that the roentgenograms suggested a benign process in five patients.

Gastroscopy was performed in nine patients. The neoplasm was visualized in eight instances and was thought to be carcinoma in seven. The gastric ulceration was considered benign by the gastroscopist in the other patient.

Operative Procedures. In the majority of instances the precise nature of the neoplasm remained obscure even at the time of operation. The correct diagnosis was made by the surgeon in nine cases at the time of laparotomy and in four of these support was obtained by frozen section. The neoplasm was believed to be carcinomatous in twenty-two patients, a benign gastric ulcer in four and a leiomyosarcoma in one.

TABLE II
ROENTGENOLOGIC DIAGNOSIS IN THIRTY-THREE CASES OF GASTRIC LYMPHOMA

Type	No. of Cases
Carcinoma	22
Lymphoma	4
Probable tumor	1
Pyloric obstruction	1
Polypoid tumor	1
Polypoid gastritis	1
Benign tumor	1
Gastric ulcer	2
Total	33

Removal of the gastric lymphoma by partial gastrectomy was the procedure most frequently undertaken in the series. Partial gastrectomy with either gastrojejunostomy or gastroduodenostomy was performed upon seventeen patients. In one of these there had been direct extension of the lymphoma to the left lobe of the liver, and partial left hepatic lobectomy accompanied partial gastrectomy. Resection of the proximal portion of the stomach with esophagogastrostomy was utilized in four. In one case segmental resection of the stomach was performed. Ten patients were subjected to total gastrectomy.

In five patients the diagnosis was established by biopsy without removal of the neoplasm. One patient was found to have an enlarged supraclavicular lymph node which was removed for purposes of diagnosis. Laparotomy was performed upon four patients in whom the extent of the lesion precluded removal. Evidence of metastatic involvement of the liver was absent in the patients in the series.

Pathologic Findings. Malignant lymphomas are characteristically soft and rubbery in consistency. Induration may be present when chronic ulceration is present but otherwise the hardness which is associated with carcinoma is absent. Transection of the tumor demonstrates a pale, white or slightly gray surface which has been compared to fish flesh. Secondary deposits are similar in appearance and consistency. Gross evidence of direct extension into neighboring organs was

TABLE III
GROSS APPEARANCE OF MALIGNANT LYMPHOID NEOPLASMS OF STOMACH

Type	No. of Cases
Ulcerating	20
Intramural	9
Intramural with ulceration	3
Polypoid	3
Polypoid with ulceration	1
Total	36

found in eight cases. Liver, pancreas, transverse mesocolon and greater omentum were involved in these.

Gastric lymphomas may be classified into five groups according to gross appearance. (Table III.) Ulcerating tumors were most common in the present series. The ulcerations varied from 1 to 10 cm. in diameter in this group of twenty. The intramural group was composed of ten lesions. Diffuse thickening of the gastric walls without significant involvement of the serosal or mucosal layers characterized this category. Polypoid projection into the gastric lumen was present in only four cases and ulceration was associated with one of these. Three tumors were predominately intramural but had associated ulceration and were thus placed in a separate group. Prominence of rugal folds was not striking in the gross examinations of the specimens in this series. The only two cases in which this finding was notable were classed as having intramural tumors.

Lymphadenopathy has been deceptive in the assessment of secondary involvement of the regional lymph nodes. In the majority of the patients in this study neoplastic extension to the lymph nodes was thought to be present at the time of operation. However, metastatic involvement of the regional nodes was present in only fifteen when histologic examination was performed.

Malignant lymphoid neoplasms have been divided into three types according to histologic differentiation: lymphosarcoma, reticulum cell sarcoma and Hodgkin's disease [9]. This division is based upon the predominant microscopic appearance and it has been observed that the cellular configuration of the neoplasm may vary in different areas. In addition, variations in the histologic structure of the lymphoma may occur at different stages in the evolution of the neoplasm. This was exemplified by one case in the present series in which a diagnosis of Hodgkin's disease of the stomach was made when partial gastrectomy was performed. The patient died six years later from generalized lymphoma and at this time the predominant histologic pattern was reticulum cell sarcoma. Lymphosarcoma was the histologic type of gastric lymphoma most frequently encountered in the present series, and accounted for twenty cases. A diagnosis of reticulum cell sarcoma was made in twelve cases and in five patients Hodgkin's disease of the stomach was present.

Results. Of the five patients in whom the diagnosis was established by biopsy without definitive removal of the neoplasm, three are known to have died within six months. The remaining two were in homes for terminal care one and three months, respectively, after discharge from the hospital.

Thirty-two patients were subjected to definitive surgical removal of gastric lymphomas and two deaths occurred in the immediate postoperative period, an operative mortality of 5.4 per cent. Twenty-eight patients were admitted to the hospital prior to 1953 and twenty-four of these were subjected to definitive surgical removal of the neoplasm. Both of the postoperative deaths were in this group. Thirteen patients lived for five years or longer. Thus, 59 per cent of those who left the hospital survived five years after curative operations, which is 40 per cent of the entire group. Five of the patients who lived five years or longer had been found to have extension of the lymphoma to the regional lymph nodes and one of these had not received roentgen therapy after operation.

SARCOMA OTHER THAN LYMPHOMA

Malignant gastric neoplasms of mesenchymal origin, exclusive of lymphomas, were encountered in thirteen patients. In eleven, the neoplasm was leiomyosarcoma. Fibrosarcoma of the stomach was found in one patient and myxosarcoma in another. The series included seven men and six women. Their ages ranged from sixteen to seventy-eight years.

Gastrointestinal bleeding led to the hospital admission of ten. Six patients had experienced massive hemorrhage which had been mani-

fested by hematemesis and melena. Epigastric pain was present in six patients but only in two was this the presenting complaint. In five the pain had been relieved by the ingestion of food or alkali. Weight loss of 4 to 15 pounds had occurred in seven patients. Two patients had sought medical attention because they had detected an abdominal mass. There was a marked variation in the duration of symptoms in this group. One patient was admitted two weeks after evidence of bleeding from the gastrointestinal tract had been noted. One patient had suffered from epigastric pain for ten years prior to admission. Four years have elapsed since removal of a leiomyosarcoma and this patient has not had recurrence of the abdominal discomfort.

An upper abdominal mass was present at the time of physical examination in eight patients. Seven of these patients were found to have leiomyosarcoma and one a gastric myxosarcoma. Except for findings which are associated with blood loss, examination of this group of patients was otherwise unremarkable.

Laboratory studies contributed little of diagnostic significance before operation. Hemoglobin values reflected the amount of gastrointestinal bleeding that had occurred and varied from 4.6 to 14.5 gm. Gastric analysis was performed in nine patients. Free acid was absent in the fasting specimen in each instance. Ten to 40 units of free acid appeared in four patients after stimulation with histamine or alcohol.

Radiologic studies of the upper gastrointestinal tract were obtained in twelve of the thirteen patients. In two patients with leiomyosarcoma, the correct diagnosis was made prior to operation. A radiographic impression of leiomyoma was made in the patient with the gastric fibrosarcoma. Gastroscopy was performed once, in a patient with a leiomyosarcoma, and an impression of gastric sarcoma, probably of myogenic origin, was given.

Operative Considerations. Malignant connective tissue neoplasms of the stomach can be identified at the time of operation in the majority of cases, and this was possible in twelve of the thirteen cases in the present series. One patient refused operative treatment and the diagnosis was established at the time of necropsy.

Removal of the neoplasm was accomplished by partial gastrectomy in seven patients. In six of these, resection of the distal portion of the stomach was undertaken and gastrointestinal continuity was maintained by means of gastrojejunostomy. In one, the proximal portion of the stomach was removed and esophagogastrostomy was performed. Segmental resection of the stomach was employed in two patients and wedge resection in three. In these patients the small extent of attachment of the tumor to the stomach permitted a limited resection of the stomach. In two patients incomplete removal of the neoplasm was obtained at the time of gastrectomy because of the extent of the tumor.

Results. The twelve patients who were subjected to operative procedures survived the immediate postoperative period. The patient who refused operation died three months after admission to the hospital, fifteen months after the onset of symptoms. Ten of the twelve patients who were treated by surgical means were subjected to operation more than five years previously and six lived for more than five years. One of the ten patients had incomplete removal of a leiomyosarcoma and died after operation. In one patient recurrence of a leiomyosarcoma developed six years after operation and resulted in death. Evidence of recurrence has not appeared in the five additional patients who have survived for more than five years. Two patients have been operated upon within the past five years. In one of these, removal of a leiomyosarcoma was incomplete and recurrence has occurred.

Pathologic Findings. Gross examination of the neoplasms did not distinguish between leiomyosarcoma, fibrosarcoma and myxosarcoma of the stomach in this group. Differentiation was established only by microscopic study.

Inspection has demonstrated these neoplasms to be lobulated, grayish to purple in color and traversed by large vascular channels. The cut surface has a pearly white appearance interspersed with areas of hemorrhage into the substance of the tumor. These tumors have been divided into three groups according to their gross appearance and location. This division classifies the tumor into exogastric, endogastric and intramural types. Such classification is feasible because these neoplasms

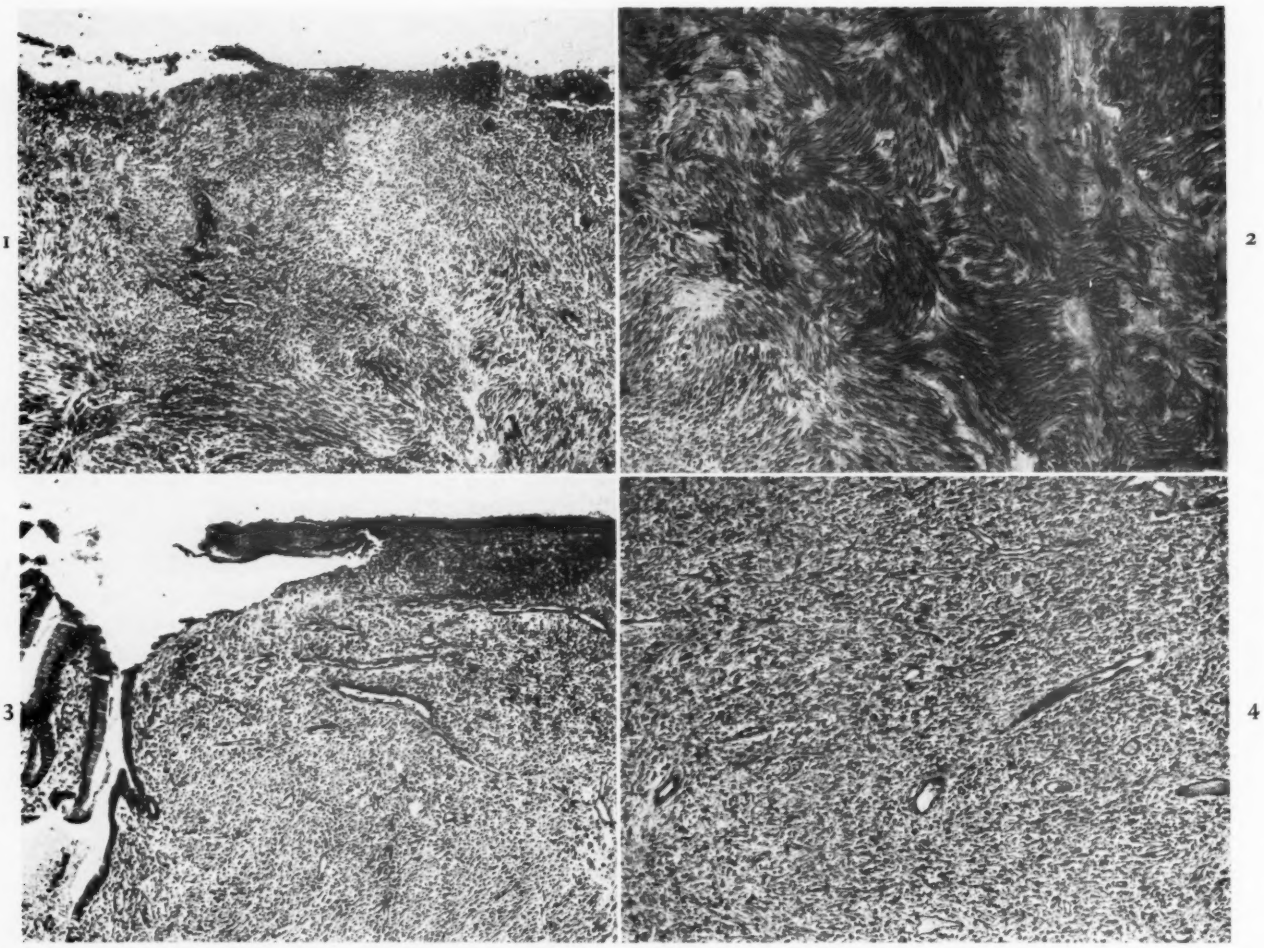

Fig. 1. Leiomyosarcoma. The surface is ulcerated and covered by exudate. The deeper portions of the tumor show the characteristic pattern of interlacing bundles of elongated cells. Hematoxylin and eosin.

Fig. 2. Leiomyosarcoma. Palisading of nuclei. Hematoxylin and eosin.

Fig. 3. Fibrosarcoma. Beneath the ulcerated surface the tumor is composed of a uniform sheet of fibroblastic cells that replaces mucosa and submucosa and extends into the muscularis. Hematoxylin and eosin.

Fig. 4. Myxosarcoma. The structure is similar to the fibrosarcoma but between the cells there is mucus. Hematoxylin and eosin.

tend to grow by expansion rather than by infiltration. In the present series infiltrative characteristics were evident in only one patient and this tumor was placed in the intramural category.

Seven neoplasms were considered to be predominantly exogastric. Four of these had origin from the lesser curvature of the stomach and expanded into the gastrohepatic ligament. Three originated from the greater curvature of the stomach and from the fundus and were located in the left hypochondrium. The largest measured 33 cm. in diameter. The extent of attachment of the tumors to the gastric wall varied but was small in proportion to the size of the tumor mass. The largest had a gastric attachment that measured 5 cm. in its greatest diameter. Ulceration of the gastric surface was present in all of the exogastric tumors. The diameter of the ulcerations varied from 2 mm. to 2 cm.

Four neoplasms were placed in the endogastric category. The largest was 10 cm. in diameter. These tumors were solid rather than cystic with central ulceration in two instances. Three arose from the lesser curvature and one from the anterior wall of the stomach. Transection demonstrated the soft consistency of the tumors with areas that were semigelatinous. The fibrosarcoma and three leiomyosarcomas were listed as present in this group.

Direct extension of these malignant mesenchymal neoplasms into adjacent organs (liver, pancreas, spleen and left adrenal gland) were observed in two cases. Regional lymph node metastasis was detected at the time of operation in four patients and hepatic metastases were noted in two.

Microscopically, all of this group of tumors was composed of long spindle-shaped cells. The eleven leiomyosarcomas were quite uniform and there was no difference in the structure or cytology of the exogastric, endogastric or intramural growths. The elongated muscle cells tended to have abundant cytoplasms that took a reddish brown color with Masson's trichrome stain. The nuclei were prominent, flattened ovals with frequently blunted ends. These cells were arranged in interlacing whorling bundles and strands in which the nuclei of rows of adjacent cells all fill in the same place in the bundle, producing the so-called palisade effect. (Figs. 1 and 2.)

The tumor classified as a fibrosarcoma (Fig. 3) and the related myxosarcoma (Fig. 4) were quite similar save that in the interstices of the latter there was much mucin. In these the cells were smaller, there was less cytoplasm and more fibrils. The Masson stain was faintly positive for collagen and entirely negative for muscle. The tumor cells were arranged in solid sheets that were everywhere the same and contained no suggestion of the palisading, whorling, interlacing structure of the leiomyosarcomas.

COMMENTS

A striking similarity among the patients with gastric sarcoma has been the difficulty of correct diagnosis before operation or pathologic examination. This is due, in great part, to the relative infrequency with which these neoplasms are encountered in relation to carcinoma of the stomach. With the possible exception of leiomyosarcoma, there is little to distinguish the signs and symptoms of gastric sarcomas from carcinomas. Leiomyosarcomas often produce massive gastrointestinal bleeding and physical examination often demonstrates an abdominal mass. When these findings are corroborated by radiologic evidence of an extraluminal gastric defect, the diagnosis of gastric leiomyosarcoma is appropriate [8].

Lymphoma should be suspected more often at the time of operation. Bulky tumors of the stomach without evidence of metastasis to the liver or ascites should suggest the possibility of lymphoma. The consistency of gastric neoplasm, which is rubbery rather than hard, should also lead to the suspicion that a lymphoma is present. The establishment of the correct diagnosis would seem to be of considerable importance because it has appeared from our findings that extensive operative procedures with wide clearance of the neoplasm is, perhaps, unnecessary in the surgical treatment of lymphoma of the stomach. Survival for long periods has occurred even though the neoplasm has been found to extend to the line of transection as determined by histologic examination of the specimen.

After operation, consideration should be given to supplementary treatment with roentgen therapy for those patients with gastric lymphoma. While the evidence is not conclusive, this form of therapy seems to be indicated [3]. This present series and other studies have suggested that a beneficial influence is obtained by the routine use of postoperative roentgen therapy on the survival of patients who have had definitive resections for gastric lymphoma [9].

Establishment of the correct diagnosis at the time of operation is usually not difficult among the group who have malignant mesenchymal neoplasms, exclusive of lymphoma. It appears that limited resection of the stomach is as efficacious as more extensive gastrectomy. Furthermore, an effort should be made to remove the bulk of the tumor even though it is necessary to leave residual tumor. One patient in the present series survived six years after incomplete surgical excision. Roentgen therapy does not seem to be beneficial in the treatment of this group.

SUMMARY

During the twenty-six-year period from 1932 to 1957, fifty patients with gastric sarcoma were encountered on the pavilion service of The New York Hospital. Of the fifty sarcomas, thirty-seven were lymphomas, eleven were leiomyosarcomas, one a fibrosarcoma and one myxosarcoma. During the same period, a total of 670 malignant gastric neoplasms were encountered so that sarcoma

represents 7.4 per cent of malignant gastric lesions [*5,7*].

The clinical and laboratory findings seldom led to the correct diagnosis before operation.

Thirty-two of thirty-seven patients with malignant gastric lymphoma were subjected to definitive surgical removal of the neoplasms. There were two deaths after operation. Thirteen patients have survived for five years or longer which represents 59 per cent of those who are eligible for computation of five-year survival rates.

Of the remaining thirteen patients with malignant gastric sarcomas, twelve were subjected to surgical intervention. There was one death after operation. Six patients survived for more than five years; one died of recurrence six years after operation.

Thus, for the entire series of fifty patients, nineteen patients survived for five years or longer. The prognosis for patients with sarcoma of the stomach is considerably better than for those with carcinoma [*2,6*].

Roentgen therapy is recommended for those patients who are found to have gastric lymphoma but not for patients with other types of gastric sarcoma.

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Early Care of the Patient with Multiple Fractures

SHERMAN S. COLEMAN, M.D., *Salt Lake City, Utah*

From the Department of Surgery, University of Utah College of Medicine, Salt Lake City, Utah.

THE inexorable increase in traffic on our highways makes any report dealing with trauma a timely one. Thus, the importance of the present subject is obvious. This discussion concerns itself with three major points: (1) evaluation of the patient, (2) systemic and local alterations in the patient with multiple fractures, and (3) treatment program. It is not designed to introduce anything particularly new; rather, it is intended to bring into focus certain concepts of treatment which are either frequently forgotten or not universally known.

EVALUATION OF THE PATIENT

For convenience of discussion a case of multiple fractures is defined as any patient with fracture of more than one major long bone. Many persons who have such fractures will also have associated injuries to the head, thorax or abdomen, and in some of these the fractures will be a secondary problem. Therefore, initial evaluation of the patient with multiple fractures must include a critical appraisal of the patient's general condition, his vital signs and the extent of all associated injuries [3]. During this early period of evaluation it is essential that there is an adequate airway and that hemorrhage and shock are under control or are being combatted.

An accurate picture of the patient's total problem can best be secured through the team approach. When feasible, appropriate members of involved surgical specialties should be enlisted to evaluate all phases of the patient's injuries. The over-all management of the patient during evaluation should be handled, as suggested by McCarroll [4], by that member of the team whose specialty concerns itself most imminently with the welfare of the patient. In this regard, except for life-threatening hemorrhage from major arterial damage to the extremities, fracture care *per se* takes low priority. Even in the case of open fractures, definitive orthopedic care must await treatment of other more urgent problems involving the head, thorax and abdominal viscera. Diagnostic roentgenographic studies of the extremities are *contraindicated* until the patient becomes predominantly an orthopedic problem or until it is deemed safe to procede with definitive fracture care. During the early period of total patient evaluation, splinting of fractures can be easily accomplished without the need or benefit of x-rays.

SYSTEMIC AND LOCAL CHANGES

The changes which occur in the patient with multiple fractures are both local and systemic. The local changes are quite variable and deal essentially with principles of individual fracture care. These will not be dealt with herein. The systemic changes are rather constant in their occurrence in every patient of this type, and may be grouped as to type and time of occurrence as follows:

I. Early systemic changes (up to 48 hr.)
   A. Circulatory changes
      1. Severe blood loss (which may lead to shock)
      2. Shock due to trauma to tissue or neurogenic factors

II. Late systemic changes (after 48 hr.)
   A. Renal dysfunction
   B. Metabolic changes
      1. Protein
      2. Carbohydrate
      3. Mineral

FIG. 1. Pelvic x-ray of a sixty-five year old white woman who sustained comminuted fracture of right ilium, pubis and ischium when struck by a car. Except for avulsion fracture of greater tuberosity of right humerus discovered several days later, no other injuries were discernible and there were no open wounds. The soft tissues of the right thigh, buttocks and pelvic regions were diffusely swollen. No evidence of visceral damage or intra-abdominal bleeding was found at any time. Whole blood, 3,500 cc., was required during the first twenty-four hours in order to stabilize blood pressure and pulse. This case illustrates the degree of interstitial hemorrhage possible in some severe fractures, even in the absence of open wounds.

The hospital records of twenty patients having multiple fractures were analyzed.* Cases of major injury to the head, thorax or abdomen were excluded. The study was designed to determine the degree of major circulatory changes, the incidence of renal complications and the significance of the metabolic changes. The findings of this analysis are integrated in the following discussion.

Circulatory Changes. Each patient with multiple fractures sustains a circulating blood loss of between 500 and 3,000 cc. during the first forty-eight hours. The amount of blood lost varies with the severity of the fractures, their location and the degree of associated injury to the soft tissues, but it occurs whether the fractures are open or closed. Unseen, interstitial hemorrhage is deceiving and astonishingly great, particularly in fractures of bones having abundant surrounding soft tissue such as the pelvis and femur. (Fig. 1.) Estimates of average blood loss for individual closed fractures of the major bones are listed in Table 1.

* Cases were derived from records in the Latter-Day Saints, Salt Lake County General and Salt Lake Veterans Administration Hospitals, Salt Lake City, Utah.

TABLE 1
ESTIMATED INTERSTITIAL BLOOD LOSS FOR DISPLACED, CLOSED FRACTURES OF THE MAJOR BONES

Bone and Region	Range of Blood Loss (cc.)	Average Loss (cc.)
Femur:		
Trochanteric, Shaft, Supracondylar	750 to 1,250	1,000
Tibia:		
Condyles	300 to 500	400
Shaft	200 to 400	300
Humerus:		
Supracondylar	300 to 500	400
Shaft	200 to 400	300
Radius or ulna	200 to 400	300
Pelvis:		
Rami: Ischial, Pubic	200 to 500	350
Ala of ilium	500 to 1,000	750

By adding the blood loss for each fracture, a figure is derived which governs the need for and amount of replacement therapy in a patient with multiple fractures. Allowance must, of course, be made for open wounds, major arterial damage and other accompanying injuries.

In the cases of multiple fractures reviewed in this study, the amount of blood required for adequate replacement ranged from 500 to 3,500 cc., with an average of 1,825 cc. This amount is exclusive of any additional replacement necessitated by subsequent surgery. In most of the cases the amount of blood ultimately required was considerably greater than anticipated by the attending surgeon, particularly in those instances of closed fractures of the femur and pelvis.

Renal Dysfunction. Elman [2] has shown that slight degrees of renal dysfunction nearly always follow any severe trauma. This is usually of little consequence and carries no serious implication except in three groups of individuals: (1) the aged, (2) those with prior renal damage, and (3) patients with extensive damage to soft tissues. Thus, all patients with multiple fractures, and in particular those with extensive accompanying damage to soft tissues

and muscle, are potential candidates for the development of renal shutdown. This unfortunate complication develops usually during the first few days after injury but its time of onset is an individual matter. It may occur earlier in the aged and in those with predisposing renal disease.

In one patient, in the series studied, with extensive damage to soft tissues and muscle, severe renal dysfunction developed which, along with an uncontrolled electrolyte and fluid imbalance, resulted in death twenty days after injury. Pyelonephritis developed in one patient and one had transient albuminuria. Although statistically not significant, the incidence of renal complications encountered in this review serves to emphasize the importance of close attention to kidney function during the early days following multiple fractures.

Metabolic Changes. Alterations occur in the metabolism of every patient having suffered major trauma. These changes are even more far-reaching in the case of multiple fractures than in other serious trauma. Significant changes are encountered in protein, carbohydrate and mineral metabolism. Disturbances in protein metabolism are manifest by the development of a negative nitrogen balance during the first four to eight days after fracture [2]. This is believed to be the result of excessive tissue breakdown.

Changes in carbohydrate metabolism often include an unusual alteration in the glucose tolerance of patients during the early days post-trauma. Some patients with multiple fractures may show a diabetic blood sugar curve during this time. This has been called "traumatic diabetes" [2]. It is temporary, and the curve returns to normal after a variable period of time. Its cause is obscure but it may have a hormonal basis related to increased pituitary-adrenal activity incited by the stress of trauma.

Shortly after fracture hypercalciuria develops as a result of increased calcium loss from the skeleton. This is explained on the basis of disuse atrophy and is most pronounced when the limbs are immobilized in plaster casts. The hypercalciuria provokes the possibility of renal lithiasis, an important consideration in patients undergoing long-term immobilization. In the early phases of care, however, the excess excretion of calcium is of no consequence.

The results of this current study suggest that the changes in metabolism following severe injury are of no great concern during the *early* phases of treatment. Patients having special problems, such as those with diabetes and those on extensive steroid therapy are, of course, exceptions. No detailed metabolic studies were conducted on the patients herein reported; however, clinically, there were no recognizable diagnostic or therapeutic problems created as the result of any metabolic disturbances traceable to the fractures. There was one minor exception, a patient who exhibited an unexplained glycosuria which lasted but four days and who undoubtedly represents a case of "traumatic diabetes" similar to that described by Elman [2].

TREATMENT PROGRAM

In view of the foregoing discussion of the changes which occur in the patient with multiple fractures, a treatment program can be outlined. The principles governing the care of such a patient can be divided into those of a local and of a general nature. The local treatment of individual fractures is not an essential part of this discussion but it is worth while to emphasize that proper splinting of fractures is essential to prevent the development or aggravation of shock, and it will serve as adequate local treatment while the general condition of the patient is evaluated and restored to an acceptable state. In addition to splinting, first aid treatment of local open wounds of the extremities may be accomplished. During the resuscitation stage this consists simply of control of hemorrhage and application of sterile dressings in order to avoid secondary contamination. Judiciously applied compression dressings are also of help in controlling interstitial hemorrhage and edema.

The program of general supportive care is headlined by the all-important principle of maintaining an adequate airway in order to preserve a live patient. The indications for tracheotomy should be carefully weighed, and if injuries to the face, chest or head compromise a free exchange of air, tracheotomy should be performed without hesitation. The tracheotomy not only establishes an unobstructed airway but also facilitates nursing care, aids in the prevention of pulmonary complications such as atelectasis and pneumonia, and provides a convenient route for

TABLE II

DATA ON PATIENT WITH BILATERAL CLOSED FRACTURES OF FEMORAL SHAFT*

Date	Blood Pressure (mm. Hg)	Pulse	Hematocrit (%)	Hemoglobin (gm. %)	General Condition	Treatment
7/26/57 (admission)	120/70	106	39	....	"Mild shock"	1,000 cc. dextrose in distilled water
7/27/57	130/60	128	38	....	Restless, nauseated, vomiting	.....
7/28/57	160/40	140	..	....	Taking liquids, vomiting ceased	1,000 cc. dextrose in distilled water
7/29/57	142/60	140	..	....	Eating better	.....
7/30/57	156/30	100	..	....	Surgery scheduled	.....
7/31/57	.....	...	20	7.0	Surgery cancelled	1,000 cc. whole blood
8/1/57	.....	...	28	10.0	.....	1,000 cc. whole blood
8/2/57	.....	...	41	13.0	Surgery	.....

* R. L., a twenty-four year old white man, sustained bilateral closed fractures of the femoral shaft on July 26, 1957. On admission to the emergency room the patient was in "mild shock," although blood pressure, pulse and hematocrit were within normal limits. No blood was given. The patient was in impending shock until intravenous and oral fluids restored the circulating blood volume. By hemodilution, the hematocrit and hemoglobin were sharply reduced, revealing the degree of interstitial hemorrhage which had occurred but which was "masked" by dehydration. The 2,000 cc. blood loss was inevitable and should have been recognized on admission.

the administration of oxygen and inhalation anesthetics.

Analgesics and narcotics for the control of pain are often essential in order to prevent aggravation of shock. In the presence of minor injuries to the head when the patient is conscious, Demerol® or codeine may be given for pain. However, each case must be critically individualized in the event of associated severe injuries to the head. The administration of morphine should be avoided in any case because of its miotic effect which deprives the surgeon of a helpful aid in evaluating injuries to the head.

Since nearly every patient with multiple fractures is either in some degree of shock or is in impending shock, as a result of circulating blood loss and other factors, replacement therapy must be started at once. It is far better to anticipate the development of shock and treat it prophylactically than to wait for it to occur. This is particularly true if subsequent surgery is anticipated. In the case of fractures, whole blood is the substance of choice but plasma expanders such as dextran or serum albumin may be used early when blood is not available. If the patient is in shock, replacement therapy should continue until blood pressure and pulse have returned to a reasonably normal level and are stable. In those cases of impending or potential shock, replacement therapy should be given according to estimates of blood loss. The surgeon must be governed by clinical impressions early in the course of care, for routine hemograms are unreliable and meaningless, especially when hydration of the patient may be abnormal. (Table II.) A routine white blood cell count may be helpful in evaluating the degree of hydration, for leukocytosis, with a normal differential, is often an indication of the hemoconcentration [5]. Later in the course of treatment, blood volume studies, as suggested by Curry and Lyttle [1], may be necessary in order to evaluate blood replacement. During the early period of resuscitation, other causes of shock must be considered. Unreduced or unsplinted fractures, extensive trauma to soft tissues, severe pain and other neurogenic and psychogenic factors may produce or perpetuate shock even though adequate blood and fluid replacement have been accomplished.

Once a clear airway has been established, blood loss adequately replaced and shock controlled, additional general supportive measures may be instituted. Broad-spectrum antibiotics are indicated whenever there are open wounds. A tetanus toxoid booster should be given to all patients who are known to have been previously immunized, and tetanus anti-

toxin should be given as indicated. The value and practicality of gas bacillus antitoxin is open to question and therefore its administration is optional.

Following resuscitation and general supportive therapy, it is the responsibility of the fracture surgeon to conduct a thorough examination of the patient's musculoskeletal system. Diagnostic x-ray studies are now permissible and these should be as complete as the patient's condition and transportability allow. The indications for specific x-ray examination are determined by local physical findings but common sense dictates that all regions suggesting trauma be studied by x-ray. In the case of multiple fractures this is particularly important. Some portions of the skeleton, notably the shoulder and pelvis, are more accurately evaluated by stereoscopic roentgenograms but these, as a rule, are not urgent and may be taken when the patient can be safely and comfortably transported.

As soon as the condition of the patient allows, all open wounds must be treated as emergencies. This is particularly urgent in the case of open fractures where the threat of disabling chronic bone infection is so real. In these days of drug-resistant staphylococcal infections, even the ultimate outcome of the patient's life may depend upon proper early care of these open wounds. Thorough débridement and cleansing according to sound surgical principles is essential; whether the wounds are closed primarily or secondarily will vary with the local problem as well as with the individual surgeon. The goal is to convert all open wounds into clean, closed wounds as soon as possible.

In all patients having sustained severe injuries, particularly those with excessive damage to soft tissues, those having preexisting renal disease and those of older age groups, careful attention must be paid to the amount of urinary output and its specific gravity. Fluid intake and output must be accurately charted. The possibility of severe renal dysfunction is always present following severe trauma and its development must be anticipated, recognized and treated, for if unrecognized or improperly treated, renal shutdown with its resultant alterations in fluid and electrolyte balance may lead to a fatal outcome. It is in the early recognition and proper handling of this problem that the "team approach" reaps its greatest harvest. Thus, in the three categories of patients previously alluded to, it is especially advisable that the diagnostic and therapeutic team include a member experienced in the treatment of severe renal dysfunction and electrolyte imbalance.

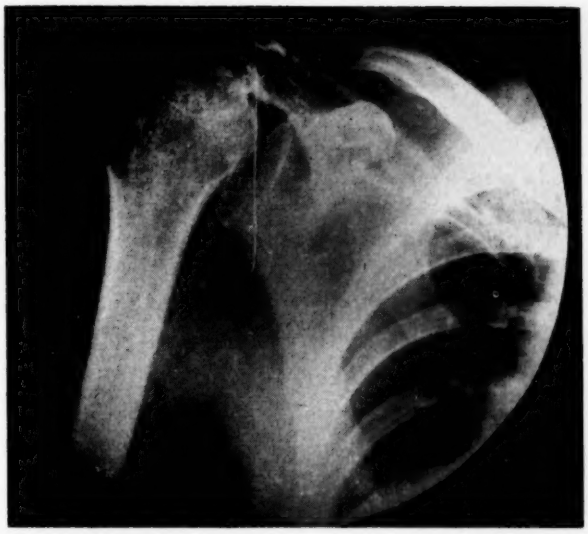

FIG. 2. X-ray of right shoulder of patient whose pelvic fracture is shown in Figure 1. The fracture of the greater tuberosity is clearly seen on the stereoscopic film, and the fragment lies inside the joint. Initial portable x-ray was of poor quality and the fracture was not recognized. This case illustrates the need not only for repeated physical examination but also for x-rays of diagnostic quality.

An individual point of importance, not usually given its deserved emphasis, concerns treatment of the occasional patient who has previously received cortisone in significant amounts. These individuals do not tolerate the stress of trauma and blood loss in a normal fashion, and aggressive hormonal replacement is essential during the resuscitation program. It is important that each patient having sustained severe trauma be interrogated concerning his use of cortisone, and those in whom hypoadrenalism might be anticipated should be appropriately treated.

A concept often overlooked in the care of this type of patient is that of *re-evaluation*. It is not uncommon for major joint derangement, or some other significant injury to an extremity, to go unnoticed for a long period of time simply because at the initial examination the patient's and surgeon's attention was drawn elsewhere. (Fig. 2.) Failure to recognize associated trauma can be obviated

by repeated thorough physical examination of the patient at regular intervals.

Last, but not any less important, is treatment of the psychological aspects of the patient having sustained multiple fractures. This applies in particular to those individuals whose injuries will demand prolonged immobilization and extensive rehabilitation. We must not disregard the importance of daily, sincere reassurance in these patients who suddenly are placed in the ranks of the physically handicapped. All too frequently the obvious injury to the extremities blinds us to the unseen, more subtle trauma sustained by the psyche. This important aspect of treatment must constantly be kept in mind to the extent that all such patients are given daily prophylactic psychotherapy by their doctor in the hope of avoiding the development of more complex and recalcitrant mental conditions requiring aggressive and costly psychiatric care.

CONCLUSIONS

1. The evaluation and treatment of the patient with multiple fractures is best accomplished by the team approach.

2. Except in unusual circumstances, the care of injuries to the head, chest and abdomen takes precedence over those of the extremities.

3. Definitive fracture care, except for splinting, is contraindicated until the patient is out of shock and has an adequate airway.

4. The average patient with multiple fractures loses about 1,800 cc. of circulating blood whether the fractures are open or closed.

5. Replacement of blood should be given to all such patients who are in shock or impending shock. Transfusion may be given selectively to others according to calculated loss, particularly to those upon whom surgery is contemplated.

6. Renal dysfunction is a constant threat in all patients having sustained multiple fractures, and is particularly prone to occur in the aged, in those with pre-existing renal disease and those having extensive injury to soft tissues.

7. In otherwise normal individuals, metabolic disturbances are rarely of any clinical consequence early in the course of treatment. Diabetic persons and those on steroid therapy are special problems.

8. Psychotherapy is especially important in the care of patients with multiple fractures.

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Clinical Evaluation of Povidone-Iodine Aerosol Spray in Surgical Practice

ARTHUR L. GARNES, M.D., ELVYN DAVIDSON, M.D., LAWRENCE E. TAYLOR, M.D., AUGUSTO J. FELIX, M.D., BORIS A. SHIDLOVSKY, B.S. AND AARON PRIGOT, M.D.,
New York, New York

From the Department of Surgery of Harlem Hospital, Department of Hospitals, New York, New York. This investigation was supported, in part, by a grant from the Tailby-Nason Co., Inc., Dover, Delaware.

IODINE, one of the most efficient antiseptics, has been used by the medical profession for over 100 years. The solution is effective against bacteria [1], fungi [2] and viruses [3]. There are, however, several problems inherent in the use of iodine as an antiseptic. Iodine is unstable and insoluble in water. To achieve a clinically applicable solution, solubility is attained using alcohol and salts of iodine. The resulting solution is irritating to the skin, causing local reactions of varying severity. The aqueous solution is of lower antiseptic value because the antiseptic I_2 must be converted into non-antiseptic I_3^- in order to solubilize in water.

In a search for substances which would reduce the undesirable side effects without alteration of the antiseptic properties of iodine, polyvinylpyrrolidone (P.V.P., povidone) was studied. This water-soluble polymer was utilized early as a blood volume expander [4–7] and detoxifying agent. It was further developed as a drug vehicle and the solutions obtained produced a protective water-soluble film on drying.

Povidone acts as a carrier of iodine in water solutions. Shelanski and Shelanski [8] and other investigators [9] demonstrated that iodine in such solutions became a stable organic complex. The solubilized povidone-iodine has enhanced antisepsis as compared to an equivalent concentration of ordinary iodine because of a lesser amount of I_3^-. With the use of povidone-iodine the germicidal action of the iodine is prolonged and the danger of cutaneous irritation, sensitization reactions and burns is minimized [10].

In vitro studies, undertaken preliminary to the clinical trial of a povidone-iodine combination in surgical problems, indicated that polyvinylpyrrolidone has no antibacterial effect. The combination of the polymer with iodine has a germicidal effect similar to that of tincture of iodine. Animal studies, in which paired scarified lesions were employed, demonstrated that neither povidone nor povidone-iodine interfered with wound healing.

For this study povidone-iodine was supplied as an aerosol spray.* The concentration is so adjusted that an 0.5 per cent solution of available iodine is delivered at the site of contact with the body surface. The site is stained so that the color indicates the areas that have been covered. Since povidone-iodine is soluble in water, the iodine stain may be removed when desirable by wiping with a water-dampened sponge.

We found that the spray application of the antiseptic saves time, facilitates the application of the medication, covers the area thoroughly, including body crevices, and minimizes destruction of tissues and the hazard of microbial colony transfers which are inherent in the practice of swabbing over areas denuded of skin. By the use of the povidone-iodine spray the discomfort is minimized and transitory. No local or systemic reactions to iodine were encountered.

The povidone-iodine spray was used as an antiseptic in the following situations: (1) for the emergency suture of lacerations, (2) for preparation of the skin prior to surgical procedures, (3) as an adjunct in the therapy of

* Betadine Aerosol Spray, supplied by the Tailby-Nason Co., Inc.

burns, and (4) for the treatment of chronic ulcers of the leg.

SURGERY

In the Emergency Ward povidone-iodine was employed as a skin antiseptic in the preparation of lacerations for suture. Two hundred lacerations were so treated. The wounds were cleaned of all foreign material, débrided and sprayed with povidone-iodine prior to suture. On very few occasions slight discomfort was reported by the patients when the medication came in contact with the open wounds. All wounds healed *per primam* without side reactions or evidence of local irritation.

For the preparation of the skin for operation, in accordance with tradition, the site was shaved and the skin cleansed with soap and water. The area was wiped dry and povidone-iodine sprayed over an adequate surface. Bacteriological cultures taken from the sites before and after operation indicated that all pathogens were eliminated by this procedure, the only remaining organisms being saprophytes and diphtheroids. Biopsy of the skin showed no penetration of the epidermal layers.

The spray was employed in 100 surgical procedures, as listed in Table 1. It is significant that although the majority of these cases involved established peritonitis or peritonitis due to spillage of intestinal contents, there were no wound infections in this series and all operative incisions healed *per primam*.

TABLE 1
PREOPERATIVE PREPARATION OF BODY SURFACE WITH POVIDONE-IODINE SPRAY

Diagnosis or Procedure	No. of Cases
Appendectomy for ruptured gangrenous appendicitis	22
Herniorrhaphy	22
Exploratory laparotomy	10
Emergency resection of bowel for gangrene secondary to adhesions	10
Stab wound of abdomen with peritoneal contamination	10
Cholecystectomy	8
Subtotal gastrectomy for ruptured carcinoma or ruptured ulcer of stomach and duodenum	8
Gunshot wound of abdomen with peritoneal contamination	5
Mastectomy	5
Total	100

BURNS

In recent years there has been renewed interest in the open or exposure treatment of burns [*11,12*]. Exposure of the wound to air reduces the opportunity for infection by producing the following conditions unfavorable for bacterial growth: temperatures below that of the body (most bacteria flourish at body temperature), lack of moisture (drying being generally injurious to bacteria), and exposure to light (darkness being conducive to bacterial growth).

The spray application of povidone-iodine is an ideal adjuvant to open therapy of burns. Following the application of the compound, the released iodine reacts with the host's organic fluids and precipitates protein, forming a firm crust under which no organisms can be trapped because of the continuing action of the iodine. This crust affords protection from reinfection and promotes an anaerobic environment unsuitable for the proliferation of many species of pathogenic microorganisms. These wounds as a consequence are remarkably free of noxious odors.

From December, 1956, to December, 1957, povidone-iodine was used in the treatment of sixteen patients with severe burns. As illustrated in Table II, seven patients (43 per cent) had second degree burns and the remainder (57 per cent) had third degree burns. The second degree burns varied in extent from 10 to 20 per cent of the body surface and the third degree burns from 5 to 40 per cent. These burns were treated by spraying with povidone-iodine with minimum delay after admission of the patients to the hospital. The spray was applied every twelve hours for the first seventy-two hours and daily thereafter until separation of the eschar began.

The observed average time of healing of the second degree burns was fourteen days. In the third degree burn areas, skin grafting was undertaken as soon as healthy granulations were present in any part of the wound. Grafting was performed in successive stages until resurfacing was complete.

The following case is representative of the third degree burn cases in which povidone-iodine was used as treatment:

Patient A. S. (Case XI), a seven year old girl, was admitted to the hospital on February 28, 1957, after sustaining third degree flame burns of the trunk and right upper extremity. (Fig. 1.) Local

FIG. 1. Case XI. Burn on admission, February 28, 1957.

FIG. 2. Case XI. March 12, 1957. Appearance of burn eschar before daily povidone-iodine spray.

FIG. 3. Case XI. March 12, 1957. Appearance of burn eschar after daily povidone-iodine spray.

FIG. 4. Case XI. March 26, 1957. Appearance of wound after separation of most of eschar.

FIG. 5. Case XI. June 27, 1957. Resurfacing complete twenty-three days after discharge.

TABLE II

DATA ON BURNS TREATED WITH POVIDONE-IODINE SPRAY

Case No. and Initials	Sex and Age (yr.)	Site of Burn	Degree and Depth of Burn	Extent of Burn (%)	Clinical Course
I, H. W.	F,30	Upper and lower extremities	2nd and deep 2nd	15	Spontaneous healing in 4 wk.
II, J. D.	M,48	Trunk and lower extremities	2nd and 3rd	20	Spontaneous healing of trunk; skin grafting of thighs in 1 stage with complete "take"
III, J. W.	M,30	Trunk	2nd	10	Spontaneous healing in 10 days
IV, I. D.	F,38	Face and scalp	Deep 2nd	6	Spontaneous healing in 4 wk.
V, J. McK.	M,35	Trunk	2nd	10	Spontaneous healing in 10 days
VI, D. B.	M,25	Trunk	2nd	10	Spontaneous healing in 2 wk.
VII, G. S.	F,7	Trunk	3rd	15	Skin grafting of trunk in 1 stage with 90% "take"
VIII, I. W.	M,40	Leg	3rd	7	Skin grafting of trunk in 1 stage with 100% "take"
IX, W. S.	M,59	Head, neck and extremities	3rd	40	Died 13 days postburn of toxemia; no evidence of infection of eschar
X, A. G.	M,57	Trunk and extremities	3rd	40	Died 18 days postburn of toxemia and cerebral vascular hemorrhage; no evidence of infection of eschar
XI, A. S.	F,7	Trunk and extremity	3rd	25	Skin grafting in 2 stages; resurfacing complete in 4 mo.
XII, E. R.	F,47	Lower extremities	3rd	10	Skin grafting in 1 stage with complete "take" of graft
XIII, H. S.	M,53	Forearm and elbow	3rd	5	Skin grafting in 1 stage; graft did not "take"; wound healed spontaneously
XIV, E. K.	M,40	Hands	3rd	5	No evidence of infection; early excision and skin grafting was planned but patient developed an acute psychosis and was transferred to another hospital
XV, H. R.	M,46	Leg and knee	3rd	5	Skin grafting in 1 stage with complete "take" of graft
XVI, P. P.	F,51	Trunk and extremities	2nd	20	Spontaneous healing in 2 wk.

therapy consisted of the application of povidone-iodine spray every twelve hours for three days and daily thereafter until separation of the eschar began. (Figs. 2 and 3.) Thereafter separation of the eschar was hastened by the use of débriding enzymes and saline baths. (Fig. 4.)

Skin grafting was completed in two stages. The patient was discharged on June 4th with the wound entirely resurfaced except for a few islands in the right axilla. When seen twenty-three days after discharge, resurfacing was complete. (Fig. 5.) The release of a mild contracture of the right axilla is now contemplated.

STASIS ULCERS

A group of fifteen patients with stasis ulcers of the legs were treated with povidone-iodine. The ulcers were sprayed twice or three times weekly with the antiseptic medication, and compression bandages were applied. No side reactions or satellite ulcers developed in this series. Povidone-iodine aided in the maintenance of an environment ideally suited for healing.

The prolonged course of treatment in five patients with stasis ulcers was appropriate for special study of possible systemic absorption of iodine. The spray was applied three times weekly for a period of one month. There was no appreciable change between pre- and post-treatment levels as revealed by protein-bound iodine determinations.

In ulcers larger than 4 cm. in diameter epithelization is extremely slow or impossible, an observation explained by the studies of Hartwell [13] on the mechanisms of healing. Such ulcers often require excision and skin grafting, and this procedure was resorted to in some cases in this series.

The following case is representative of the satisfactory response of stasis ulcers to povidone-iodine spray therapy:

Patient J. B. (Hosp. No. 56-18518), a sixty year old man, struck his leg against a chair in June, 1957. He treated the leg with home remedies. Professional medical advice was not sought until he came to the clinic three months after injury.

On examination an ulcer was found on the anterolateral aspect of the lower third of the left leg. The ulcer measured 3 cm. in diameter and had sclerosed edges, a sluggish granulating base and hyperpigmentation of the surrounding skin. No varices were present. There was pitting edema of the leg (2 plus). The dorsalis pedis was not palpable. Blood serology gave normal results.

The ulcer was sprayed with povidone-iodine and an Elastoplast® bandage was applied from the base of the toes to the knee. This therapy, repeated twice weekly, resulted in prompt improvement and the ulcer was completely healed eight weeks after the beginning of treatment.

SUMMARY AND CONCLUSIONS

The complex, povidone-iodine, in the form of an aerosol spray, was used as an antiseptic and germicide in the preparation of lacerations for emergency surgery, in the preparation of the skin for surgery, and in the treatment of burns and stasis ulcers:

Surgery: In 200 emergency suture procedures and 100 major operations povidone-iodine proved to be an excellent germicidal agent.

Burns: This medication and method of application facilitates the open therapy of burns, providing a protective covering for areas denuded of skin. Its antiseptic properties control infection and inhibit odor. Severely burned children found this form of treatment to be acceptable.

Stasis ulcers: This condition responds to povidone-iodine therapy in addition to compression to aid circulation.

Povidone-iodine spray aids in the maintenance of an ideal environment for healing. Even when applied to large, open wounds, discomfort was mild and transitory.

No evidence of local or systemic toxicity and no dermatitis or satellite ulcers were observed. Protein-bound iodine determinations revealed no appreciable change in pre- and post-treatment levels.

Povidone-iodine spray is a safe, time-saving, effective antiseptic and germicide for surgery, burns and stasis ulcers.

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Long Delayed Cancer of the Cervical Stump

REVIEW OF THE LITERATURE AND PRESENTATION OF TWO CASES

HUGH GEORGE BELL, M.D., *New York, New York*

From the Department of Gynecology, the Mt. Morris Park Hospital, New York, New York.

CANCER of the cervical stump is a dreadful disease but a preventable one. The diagnosis is often delayed and the treatment difficult. The disease may appear any time after the performance of the supravaginal operation. Between five and ten years appears to be the optimum time for this lesion to be detected. Recognition is given to two types of manifestations of the disease: (1) cases that are unearthed less than two years after operation are called "coincidental" and are believed to have been present even at the time the supracervical operation was performed. (2) The other lesions are uncovered after two years and are called "true" or "manifest" cases. (Table 1.)

Both types of cancer are capable of killing the victim in a short time if allowed to go untreated; the coincident lesions are even more rapidly fatal. The report by Decker et al. [1] is of great interest since it indicates that while a previous communication in 1940 showed 47.2 per cent coincidental cases, the 1957 report indicated 14.3 per cent. This, the authors point out, " . . . speaks well for the progress and thoroughness of the gynecologic examination in the past 20 years," but there is still room for improvement. The need for this improvement becomes even more evident when considered in the light of Te Linde's [2] report of finding cancer in cervices that had had careful and exacting cancer survey and had been considered free from the disease before surgery. After operation the cervices in 1,500 cases were cut up into blocks and many sections were taken from each block. In the course of this thorough examination 0.6 per cent revealed very early but undoubted cancer. This, indeed, is a powerful argument against leaving any cervix behind.

Although Decker and co-workers' communication showed that the highest incidence of cancer of the cervical stump takes place between five and ten years after operation, there are occurrences after the coincidental stage up to forty years. Only two cases in this relatively large and carefully studied series occurred in patients beyond the age of thirty. The two cases to be reported herein are interestingly long-delayed in appearance and were both observed within the same year.

It is, indeed, very difficult to be certain that the cervix being left behind is not already harboring cancer or soon will be.

INCIDENCE OF CANCER OF THE CERVICAL STUMP

Te Linde [2] aptly stated that the incidence of the development of cancer in the retained stump can only be estimated, since the true incidence cannot be determined except by following up until their death a group of women who have been subjected to supravaginal hysterectomy.

Scheffey [3] made a follow-up study of 554 women who had undergone supravaginal hysterectomy and found cancer in the cervical stump in 0.9 per cent.

Dr. H. E. Schmitz, in discussing Johnson's paper [17], stated that in his clinic the incidence of carcinoma of the stump is 4.5 per cent, but that it is his belief the over-all incidence is in the neighborhood of 1 per cent. Dr. A. W. Diddle, discussing the same paper, pointed out that 4 per cent of 885 consecutive patients treated at the University of Iowa for cervical cancer during 1926 to 1942 previously had undergone subtotal hysterectomy. The corresponding figure for all women (992) with this disease treated in Dallas, Texas, from 1936 to 1946 was 10 per cent. Among nearly 300 women treated from 1949 to September

1, 1955, at the East Tennessee Tumor Clinic the figure was over 4 per cent. It is generally estimated, according to the same discusser, that the death rate for total hysterectomy is two to five per thousand, but at the same time the total operation prevents twenty to twenty-five per thousand from dying of cancer of the cervical stump. These figures speak for themselves.

According to Hahn [4], the age of the patients varied from the youngest at twenty-nine years of age to the oldest at seventy-five years of age. Only 14.66 per cent were forty years of age or younger.

THE OVER-ALL PROBLEM OF THE RETAINED CERVIX

The cervix we leave behind may plague us unless it is kept under periodic surveillance for the duration of the patient's life. In recent years there has been a definite shift toward total hysterectomy in preference to the supravaginal procedure. This change is more noticeable in the teaching centers and in hospitals approved for resident training in obstetrics and gynecology. There is today probably no group that would stand up staunchly in favor of the supracervical operation. This was not always the case; the advocates of the subtotal operation were quick to point out that a total operation would shorten the vagina and leave it dry. No less a figure than Bonney [5] supported this view. He even listed the conditions for which he thought the total operation should be performed. The conditions were: malignant diseases of the uterus, carcinoma of the fallopian tube or ovary, tuberculous endometritis, sepsis in all its forms, hydatid disease, villous papillomas of the endometrium, inversion, acquired hematometra, and myomas with coexistent cervicitis. "For all other conditions requiring hysterectomy the removal of the body alone will be found sufficient, and in our opinion is the best." Bonney further pointed out that after removal of the cervix a scar is left across the roof of the vagina and may be the seat of hemorrhagic granulation tissue and discharge for many months. Even when healing is complete, there is puckering and constriction. The ovaries (if they have been conserved) or the intestines or bladder may become adherent to the line of peritoneal suture overlying the vagina. Any of these

TABLE 1

TEN-YEAR REPORT OF CANCER OF THE CERVICAL STUMP ACCORDING TO BRAND AND GREEN [8] (459 CASES)

Authors	No. of Cases	Coincidental* Cancer		Manifest* Cancer	
		No.	%	No.	%
Cosbie	62	24	38.7	38	61
Watkins	15	7	46.6	8	53.4
Von Graff	45	..	....	..	....
Ward	61	..	....	..	....
Beheny	67	..	....	..	....
Meigs	26	..	....	..	....
Pearse	35	7	20	28	80
Healey and Arnesa	67	..	....	..	....
Brand and Green	43	18	41.9	25	58
Decker et al	98	14	....	84	....

* NOTE: Division into "manifest" and "coincident" is a recent refinement of enlightened study.

sequelae may be the case of dyspareunia. Furthermore, he stated, the cervix has a sexual value; its secretions play an important role in the sexual act, and in some women it constitues an erotogenic zone. It was also pointed out that conservation of the cervix maintains the integrity of the vaginal vault; and as a parting blow to those advocating total hysterectomy, he stated that statistics of the day showed that carcinoma of the cervix was rather rare in women who have not borne children and rarer still in virgins.

Wharton [6], even more recently, stated that "One cannot state as a general law what cases should be treated by total hysterectomy and what cases by supracervical hysterectomy. As a general principle, however, one should choose the less extensive operation that will handle the situation."

Many of the objectionable features of the total operation as pointed out by Bonney have been overcome by improved technics. The vagina need not be shortened, for by applying the proper amount of traction on the cervix as the pubocervical layer of fascia is being developed, the fornices are straightened out and, if anything, the vagina may actually be lengthened in the operation for simple benign conditions. Also, the cause of dyspareunia may be avoided by the ordered disposition of the ovaries and intestines in

relation to the vaginal scar. Troublesome hemorrhagic granulation tissue does not always appear on the roof of the vagina; whenever it does, we have to accept it as a small price to pay for cancer prophylaxis and be heartened by the knowledge that time and gentle cauterizations will alleviate this minor inconvenience.

The absence of the cervix appears to have little or no real effect on the sexual life of most women, and finally more recent opinions suggest that nulliparous and even celibate women are just as susceptible to cancer of the cervix and cervical stump as parous women.

Most gynecologists were already familiar with the various benign conditions which may attack the retained cervix, when Dr. John A. Polak more than thirty-seven years ago called attention to the world-wide incidence of cancer of the cervical stump. Today we are learning a great deal more of the history of cervical cancer and statistics point out that the cervix is the most frequent site of pelvic carcinoma. Every reporter on the incidence of cancer of the cervix shows that the disease is by far more common in the cervix of the uterus than in the corpus. According to Te Linde [2], in his clinic it occurs eight times more frequently in the cervix; at The Woman's Hospital in New York five times more frequently; at Memorial Hospital in New York four times more frequently. It appears, then, that the supracervical operation leaves behind that portion of the uterus that is most vulnerable to cancer.

Recent investigation has strongly suggested that cervical cancer has a long latent period before it becomes manifest, so that at the very time the supracervical operation is being performed incipient cancer may already be present, and even the excellent tests we have at our disposal today may not be able to expose it. Even when the lesion becomes symptom-producing, Miller and Henderson [7] estimated that there is a lapse of almost five months to the time of the first clinical examination.

Scheffey [3], and others have pointed out that the recognition of cancer of the cervical stump and vulvar cancer usually come late. This is due to the sad fact that, all too often, the basic procedure of inspection under good lighting is neglected. Then, too, the woman who has had a supravaginal hysterectomy may be lulled into a false sense of security and thereby disregard or neglect the first early signs of impending trouble. Perhaps all women who have undergone a supravaginal operation should be advised in a modified manner of the necessity and wisdom of periodic pelvic examination. The fear of creating hysteria and cancerphobia is more than outbalanced by the knowledge that the survival rate of cancer of the cervical stump is lower than that for cancer in an intact uterus and that the treatment of cancer of the cervical stump offers more difficulties. However, the patient may not be the only one guilty of prolonging the period of delay.

The disease when first discovered may be in various stages of development as evaluated by the League of Nations Health Organization. Unfortunately, the intraepithelial lesion stage 0, and stage 1 when the disease is still confined to the cervix are the manifestations found least frequently.

Novak [10] points out that "There are two pathological types of carcinoma of the cervix, the distinction being based on their histogenesis from one or another of the two types of epithelium found in the cervix. By far the more common form is that which arises from the stratified squamous epithelium, and called for that reason epidermoid or squamous cell carcinoma. The other arises from the cylindrical gland-forming epithelium and, since it assumes a gland architecture, it is called Adenocarcinoma." The former appears in fully 95 per cent of cases, the latter in the remainder.

The discussion of cell dedifferentiation and its relationship to mortality is not within the purview of this communication. The clinical staging, on the other hand, is germane to a clearer understanding of the progress of the disease. (Tables II and III.)

Cancer of the cervix with an intact uterus or cancer in the cervical stump begins as a local and circumscribed disease. It is only after it has been allowed to continue untreated that it attacks adjacent and still later distant structures. We believe that there is a latent period preceding the spread of destruction, but how long we are not quite certain. The International Classification of staging has its basis in the extensiveness of this spread. The closer the disease remains to the site of origin, the better the possibility for complete removel. Thus stage 0, called carcinoma *in*

TABLE II
CANCER OF THE CERVICAL STUMP—STAGES OF DISEASE

Author	Stage 0	Stage I	Stage II	Stage III	Stage IV
Decker et al. [1]	0	8	27	19	15
Hahn [4]	0	35	36	46	33
Kelly and Brawner [11]	0	4	4	3	7
Creadick [13]	14	43	36	49	41
Totals	14	90	103	117	96

situ, intraepithelial or preinvasive carcinoma represents the very earliest beginning of the disease and presents the very best chance not only for five- or ten-year survival but also for complete cure in all cases. In stage I the disease is still confined to the cervix, we believe, and may be completely cured. (Table IV.)

Stages II, III and IV are less rewarding to treat and represent extent of spread away from the cervix and decrease of survival rate and longevity. In stage II the cancer extends beyond the cervix involving the parametrium on one or both sides but has not yet reached the pelvic wall. The cancer has already invaded the vagina in all but its lower third. When the uterus is present, the spread in this stage may involve the corpus. Stage III represents the further extension of the lesion, for the carcinoma has now reached the pelvic wall. Rectal examination at this time shows no cancer-free area between the tumor and the pelvic wall. Even the lower third of the vagina is engulfed at this time. What is even more important at this stage, isolated metastases are palpable on the pelvic wall. These metastases are sometimes present even in the face of seemingly small cervical lesions. Stage IV represents a widespread dissemination of cancer cells; it is almost the death knell for the patient if the disease continues its unchallenged course. Here the cancer involves the bladder as revealed by cystoscopic examinations or the presence of vesicovaginal fistula, or involves the rectum as determined by radiographic and sigmoidoscopic studies; or it may have left the true pelvis to involve distant organs such as skin, liver, brain, pancreas and spine. Mercifully, the patient usually dies before the course becomes so widespread.

At present we believe that although cancer may spread by several means, the lymphatic route of dissemination offers the greatest barrier to effective therapy. Novak has shown

TABLE III
ANNUAL REPORT—CANCER OF THE UTERINE CERVIX (HEYMAN) AS REPORTED BY DOUGLAS AND FINN [12]

Stage	No. of Patients Treated	Per cent	Five-Year Survival with No Evidence of Disease	Relative Apparent Recovery Rate (%)
I	10,582	16.5	6,214	58.7
II	23,190	36.1	9,268	40.0
III	22,911	35.7	5,000	21.8
IV	7,592	11.7	478	6.3
Unclassified	24		3	
Totals	64,236	100	20,963	32.6

TABLE IV
SURVIVAL RATES IN VARIOUS STAGES

Author	Stage	Total No. of Patients	Five-Year Survivors
Decker et al. [1]	I	8	7
	II	27	21
	III	19	12
	IV	15	4
Hahn [4]	I	8	7
	II	7	4
	III	3	1
	IV	8	0

that the " . . . route of lymphatic extension involves chiefly the segment of the lymphatic system embracing the parametrial lymphatics and glands, the iliac and hypogastric glands, with later involvement of the sacral, obturator and even the lumbar and inguinal glands in some cases. The parametrium is involved in a large proportion of even relatively early cases, and practically all of the advanced group."

Then, too, cancer of the cervix as well as of the stump does not follow a fixed pattern. Invasion and finally replacement of the surface epithelium by propagation of cancer cells from the area of the basalis before a breakthrough is affected in the basement membrane is the more familiar course. "Spray cancer," first described by Schiller behaves otherwise: the basement membrane lamina propria, and even distant stroma, are all invaded before there is any warning in the surface. The

usually helpful adjunctive tests, such as Schiller's iodine, colposcopy and even the Papanicolaou smear, are valueless. Early detection is principally fortuitous as in the case reported by Scott and Blake [*16*].

Carcinoma is not the only malignant lesion that may involve the cervical stump. There is a recent well documented case report by Cron and Mosler [*9*] showing the development of sarcoma in a cervical stump thirty-four years after operation.

CARE OF THE CERVICAL STUMP

The development of cancer in the cervical stump is even more deadly than cancer in a cervix when the uterus is present because it is more difficult to treat and the danger of overlooking or neglecting it is greater. Douglas and Finn [*12*] have pointed out that two of every three patients with cancer of the cervix die within five years and that in only 15 per cent the cancer had been detected while still confined to the cervix. Since the cervix is the most frequent site of pelvic cancer, the care of the stump is a matter of concern. The best and most effective treatment of cancer is prophylaxis. Care of the patient becomes increasingly difficult once the disease has developed.

There are those surgeons who perform cervicectomy at a later date on cervices which for one reason or another could not be removed at the first operation. Even subjecting the patient to two operations is a better alternative than allowing cancer to develop.

We are all aware that a history of bleeding from any of the body cavities may be the forerunner of serious trouble and requires urgent investigation. This is especially true of the unnatural vaginal bleedings. Bleeding may be hardly noticeable in the beginning and may appear only on contact. This type of bleeding in the presence of fibroids may be misleading to patient and doctor. We saw a patient recently who had undergone supravaginal hysterectomy for myomas of the uterus in the presence of an uninvestigated coincidental cervical cancer from which she later died.

It is amazing, as Creadick [*13*] has reported, that three patients with the diagnosis of cancer of the cervix established prior to operation still underwent supracervical hysterectomy.

Then, too, pelvic examination and speculum examination are basic features of all investigations of cancer of the cervical stump. Cytological and biopsy studies are the main anchors of any survey for cancer of the stump as well as for all other cancers. Because there is a large margin for error in cytological interpretation, false negative or false positive results must be repeated, restudied and corroborated by adequate and effective biopsy specimens. Much can be said about biopsy, the manner of collection and the adequacy of interpretation. Both require patience and diligence.

There is still some confusion about the method of collecting a specimen for study from the cervix or cervical stump which has aroused suspicion or which is undergoing routine survey. It is now pretty well established that various methods of cauterization are so disturbing to the staining characteristics of the cells that accurate nuclei changes cannot be fully appraised. We must then employ methods that do not entail the use of heat. The cold knife and the punch are admirably adopted to this plan. The method introduced by Schiller of staining the cervix with iodine solution is as employable today as it was in 1926 when it was first introduced. Its effectiveness lies in its pointing out areas that are likely to be cancerous by their failure to absorb iodine. However, it must be borne in mind that cancer cells are not the only ones that will not absorb iodine; dyskeratotic areas, scar tissue and certain cysts will also fail to absorb iodine stains. When once the specimen is obtained, however, microscopic examination will readily establish the difference. It is well to take specimens from the various quadrants of the cervix (e.g., 12, 3, 6 and 9 o'clock). But even this procedure is not adequate, as will be indicated by one of the cases to be presented. Although the squamocolumnar border is a frequent site of cancer of the cervix, many lesions have their beginning within the cervical canal. It is wise, therefore, to include this area also for study. A cold knife biopsy properly placed always includes this area and provides enough tissue for complete study.

The value of cytodiagnosis in the early detection of cancer of the cervix and cervical stump is based on the fact that the early manifestations of the disease appear first in the mucous membrane before the basement membrane barrier is broken. Broders in 1932

placed special emphasis on the need for complete scrutiny of all the manifold changes taking place in the epithelial cells.

Another reason cauterization is not to be employed in biopsy study is that the first specimen may be unsatisfactory, as it is at times, and cauterized tissues are worthless for further specimen study. However, even with enough tissue from the desired areas, the diagnosis is sometimes very difficult to make, because up to now there has been contention among pathologists regarding what is true basilar hyperactivity and what is definitely intraepithelial cancer. The diagnosis of early cancer can too often be very trying and time consuming, but the reward for success is great—the preservation of a life.

These tests are designed primarily to detect cancer in its earliest stages when therapy can be almost 100 per cent effective in every case, e.g., the intraepithelial or early stage 1 cases. Patients often tell us that they failed to seek advice before because they had no pain. When pain begins, the end is not far away; and these tests are hardly necessary to tell that the crater-like, crumbly, easily bleeding lesion or the excavating endophytic growth is advanced cancer.

One must always be alert to the deceptiveness of cancer; a small, seemingly localized growth may have widespread dissemination and be potentially fatal.

Practically any lesion beyond the intraepithelial stage may show some degree of invasiveness, depending largely on the findings in the areas selected for investigation and the care that has been exercised in the preparation of the specimen. The criteria for diagnosis of infiltration as set forth by Soule [*14*] are: (1) a distinct break in the basement membrane with infiltration of malignant cells into the lamina propria; (2) plugs of carcinoma cells deep to the endocervical glands that have caused a scirrhous reaction in the surrounding stroma; (3) clusters of malignant cells in obvious vascular spaces, usually lymphatics.

The failure to perform cytodiagnosis and biopsy studies before and after subtotal hysterectomy is largely responsible for cancer of the cervical stump.

TREATMENT

To re-emphasize what was stated before, the most effective and dependable treatment of cancer of the stump is prophylaxis. The cervix that must be left behind as determined by careful preoperative evaluation should have all the benefits of cancer detection studies. Total hysterectomy will obviate the need for further watchfulness and worry. As firmly as we believe in and advocate total hysterectomy, we know it is not always possible in the face of certain entities except by unduly prolonging the operation and perhaps accepting greater hazards.

Apart from prophylaxis, there is hardly any one method of treatment that does not have its drawbacks.

Meigs [*15*] tells us that the treatment of cancer of the cervical stump is essentially the same as that of cancer in the intact uterus. He therefore, in suitable cases, views the problem from the surgical aspect. He is quick, however, to point out the technical difficulties that this approach entails. The danger of damage to the ureters is great, and there are other immense problems from this approach.

Radiation therapy appears to have a more universal appeal in the management of cancer of the cervical stump. The use of radium and external radiation is never an innocuous procedure, and here there is the added danger of the short endocervical canal and the closer proximity of the bladder. Special technics have to be employed to overcome these problems. No set pattern of application can be given because each case must be managed individually. The two cases presented herein indicate how we manipulated these modalities. These cases require the cooperation of a skilled radiologist.

CASE REPORTS

CASE 1. A seventy-five year old widowed Negro woman, para 0, gravida 0, came under observation for the first time in February, 1957. She appeared very weak and emaciated. Her chief complaint was of profuse vaginal bleeding of twenty-one days' duration. This bleeding began as an irregular spotting but after the first week became quite brisk. She was not unduly alarmed in the beginning; but as she grew weaker and the bleeding became more severe, she decided it was time to seek medical care.

Her past history and family history are relevant and significant only to the extent that forty-six years previously she had undergone subtotal hysterectomy for what had been explained to her as "bleeding tumors." She was twenty-nine years

old at the time and unmarried. Nothing of unusual significance had happened to her during the intervening years. She rarely had need to visit physicians or to take medicines. She was very religious and her habits were moderate. Her menstrual life had begun at age seventeen with a twenty-eight-day cycle, lasting three days with no disturbing features. The pertinent feature of her present difficulty was the vaginal bleeding which was moderately profuse; the week before coming to us she had to use six to eight pads each twenty-four hours.

Her general physical condition was in keeping with that of a seventy-five year old woman who ostensibly had been rather well until the present illness. The blood pressure was 150/118 mm. Hg, the pulse slightly rapid but of good volume. The chest, except for evidences of weight loss, was normal. Heart and lungs were clinically normal. No masses or areas of tenderness could be palpated abdominally. The abdomen was scaphoid in contour. The external genitalia were those of one of her age group in reference to hair and adipose tissue distribution. The introitus barely admitted the index finger, and even this gave her much discomfort. Old and new blood escaped in moderate amounts from the vagina. The examining finger encountered a crater-like aperture which appeared fixed. We were unable to introduce even a virginal speculum. A nasal speculum was employed in the collection of specimen for cytologic studies and fragments for biopsy evaluation. Both gave positive findings. Rectovaginal examination gave the impression that the parametria and rectovaginal septum were heavily involved. There was marked hirsutism and we were told this was not a familial trait.

The blood picture was surprisingly good despite three weeks of continued bleeding. The red blood count was 3,500,000 per cu. mm., white blood count 8,500 per cu. mm., hemoglobin 10 gm. per cent, segmented neutrophils 49 per cent, lymphocytes 36 per cent, staff cells 12 per cent, monocytes 2 per cent, eosinophils 1 per cent. The Wassermann test was negative, cholesterol 260 mg. per cent and alkaline phosphatase 5.7 Bodansky units. The blood urea nitrogen was 16 mg. per cent, creatinine 1.3 mg. per cent and sugar 74 mg. per cent.

X-ray studies of the chest, skull, long bones, spine, pelvis and femoral heads revealed nothing of clinical significance. Studies of the kidney, ureter and bladder showed no involvement of that system. Barium enema and sigmoidoscopic investigations were also unrevealing. Electrocardiographic studies revealed a hypertensive pattern. The basal metabolic rate was 44 plus.

Despite the fact that the laboratory findings were fairly satisfactory, clinically the patient looked bad and grew weaker day by day. She was given adequate supportive treatment and the bleeding was brought under control by packing. In consultation with the radiologist we concluded that external radiation was best suited to her need. The lesion was regarded as stage III cancer which, other things being considered, would not benefit from other modalities.

Because of the condition of the cervix and the atresia of the vagina, we believed external radiation together with local treatment to control bleeding would be all that we could do. Ordinarily we utilize six pelvic portals with 200 r per portal, but the patient's increasing debility indicated radical curtailment of this approach. We employed only four portals and were able to give only 1,000 r per portal when she became so ill treatments had to be discontinued. The remainder of her treatment was essentially supportive, expectant and custodial. She died from spread of the disease six months after coming to us and forty-six years after submitting herself to supracervical hysterectomy.

In the following case the disease was also cancer of the cervical stump, but the diagnosis in this instance required repeat studies.

CASE II. A sixty-four year old widowed Negro woman, para 0, gravida 0, came to my office on May 23, 1956, complaining of sudden profuse vaginal bleeding that had begun twenty-four hours previously. She otherwise appeared in good health, was robust and rather obese. (She was 5 feet 8 inches tall and weighed 212 pounds.) She looked much younger than her age and quite intelligent.

The day before she had noted that she was bleeding vaginally. This was quite frightening because she had had no vaginal bleeding or unusual discharges since undergoing surgery thirty-six years previously. She went to bed and the bleeding seemingly abated; but as soon as she got out of bed, it returned even more profusely than before. It was at this time that she came to see me.

The past and family histories are not pertinent to this discussion except as they point out that her mother had died from cancer of the womb at sixty years of age and that the patient had had a subtotal hysterectomy for fibroids thirty-six years previously.

Except for obesity and for moderate hypertension (blood pressure 170/100 mm. Hg), the significant findings were confined to the pelvis. The external genitalia were normal, the introitus marital; a moderate flow of bright red blood was escaping from the vagina. The examining finger felt a cervix that was axial, tender, excoriated and

firm. The corpus was missing; the fornices were not foreshortened or full but were less resilient than in the normal state. There was left parametrial thickening and tenderness although this had not gone all the way to the pelvic wall. The right side appeared to be less involved. The rectovaginal septum felt thickened. There was a narrowing of the vagina at the apex but the other areas felt normal to touch.

Speculum examination revealed what was suspected to be an endophytic type of cancerous growth of the cervix. Papanicolaou smears were made at this examination and the vagina was packed with gauze.

Because the lesion appeared so characteristic, hospitalization and complete biopsy were advised even before the report of the cytologic studies was received. Consequently, two days later we confirmed the clinical impression by examination under narcosis and completed a biopsy study of the cervix by quadrants. To our surprise, the biopsy report was negative for malignancy. In the meantime, the Papanicolaou smear was reported positive. An endocervical curettage was then carried out as an office procedure and this time the report was invasive squamous cell carcinoma, grade III (Fig. 1). We estimated the clinical stage to be late II or early III.

Blood studies and urinalysis were within normal limits. X-ray studies of the chest, skull, long bones and pelvis showed no abnormalities. Cystoscopic studies and sigmoidoscopic and barium enema findings showed no involvement of these areas.

In consultation with the Radiologic Department we decided to treat the patient first with radium and then follow after a given interval with external radiation. The purpose in giving the radium is twofold: first for its local effect, and second for its parametrial effect. The x-ray we hoped would control glandular metastases.

We were quite concerned because of the nearness of the rectum and bladder to the area of treatment, as well as the very short cervical canal. We therefore decided to use 15 mg. bomb-type applicators and carefully pack off the rectum and bladder. Four of the bombs were employed, one placed up against the diseased cervix, another behind and one on each side. The bladder was so near the area of application that particular care was needed to protect that organ. Total dosage of 4,000 mg. hours was given as a single dose. Except for an elevation of temperature to 103°F. thirty-six hours after the insertion of the radium, there were no untoward developments during this phase of treatment or in the period of external radiation that followed six weeks later.

External radiation consisted of 1,200 r over each four pelvic portals (20 by 20) directed to the parametria, for seven weeks, three times each week.

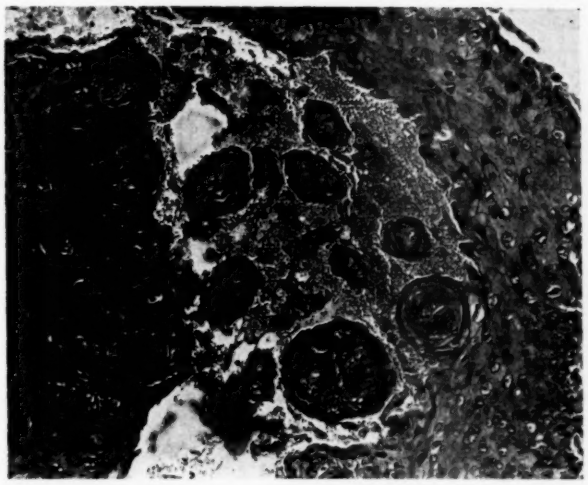

FIG. 1. Case II. Photomicrograph of biopsy specimen from the cervical stump showing invasive carcinoma thirty-six years after supravaginal hysterectomy had been performed.

Blood studies showed no significant deviation during the treatment.

Ten months after the treatment (June, 1957), the patient felt quite well and had resumed working. Monthly Papanicolaou smears and repeat biopsies showed only radiation effect. The cervix appeared atrophic but healthy.

When last seen in June, 1958, the patient had a complete physical examination and appeared to be in very good health. Cytodiagnostic tests remained negative. We are hopeful.

COMMENTS

The patient unfortunate enough to have cancer of the cervical stump is further injured when there is delay in applying curative or arresting measures. The findings of The Philadelphia Plan for Pelvic Cancer Control show that in 27 per cent of cases the delay is the fault of the physician who first saw the patient but failed to examine her properly. The patient alone is responsible for the delay in 23 per cent of the cases. The greatest delay occurs when both physician and patient unite in being neglectful, in this instance 60 per cent. Both parties may be misled by the information that the uterus has been removed, not realizing that the more vulnerable portion is left behind.

In terms of months lost before definitive therapy could be given, the patient delayed her own treatment for 15.6 months; the physician contributed 8.7 months to negligent delay. Careless patient and negligent physician

together cause a delay of 17.7 months. This, indeed, is an almost insurmountable obstacle. Procrastination is no mere thief of time here; it is a killer of faith, hope and life itself.

Whenever a surgeon proposes to perform an abdominal hysterectomy, the complete operation should be the overwhelming choice. A cervix that has been removed can never again in the lifetime of the patient give rise to cancer. The various adjunctive measures, such as better anesthesia, blood replacement, chemotherapy and antibiotics make the flimsy excuses about "curtailing the surgery to shorten operating time" sound very hollow. If the surgeon believes that in his hands the total operation is more hazardous for the patient than the supravaginal procedure, he is fully justified in utilizing the latter procedure. This will be an infrequent experience in the hands of most surgeons. Admittedly, in the face of extensive endometriosis, exceedingly large intraligamentous growths and a necrotic uterus with peritonitis, most surgeons will settle for the lesser procedure and the patient's life. However, the retained cervix should not be forgotten after the operation; it should receive periodic examination for the rest of the patient's life.

Too often the cervix is not removed because there is hurry to complete the operation; there is a lack of full realization of the danger of leaving a cervix behind, perhaps even a diseased one; or the operator believes mistakenly that the vagina will be shortened and the woman's sex life disturbed. However, these are not the only reasons the subtotal operation is performed. Unexpected events during the operation may indicate curtailment of a procedure for which the patient was not adequately prepared.

CONCLUSION

The menace of cancer of the cervical stump will completely vanish when total hysterectomy displaces the subtotal procedure whenever possible. This ideal can become a reality when the operators performing hysterectomies make a determined and conscious effort to abandon the subtotal operation as an unsatisfactory and potentially harmful procedure.

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The Management of Trauma in the Aged

PHILIP H. TAYLOR, M.D., DAVID K. HEYDINGER, M.D. AND L. C. ROETTIG, M.D., *Columbus, Ohio*

From the Surgical Service, White Cross Hospital and The Department of Surgery, Ohio State University College of Medicine, Columbus, Ohio. This work was aided by a grant from the John S. Hartford Foundation.

MANY papers have been written about the geriatric patient in general and about the preparation of the aging patient for elective surgery. Because of this the medical profession has become remarkably adept at preparing the geriatric patient for elective trauma.

To date, very few papers have been written concerning the management of the aged trauma victim. It must be remembered that in the case of the aged accident victim, he has been submitted to trauma before any protective measures have been carried out. Following an episode of accidental trauma these patients all too often are subjected to hasty and ill-advised emergency surgery.

This paper represents the initial phase of a plan formulated to unify and systematize the care of all aged accident victims sixty-five years of age and over admitted to the hospital.

Upon admission to the hospital the elderly accident victim is often viewed with pessimism. His age is unintelligently weighed against him, and his treatment thereby suffers. Actually there is much that should and can be done for these patients.

By 1980 20 per cent of the population will be sixty years of age and over. The average life span at present is 68.2 years and an eighty year old person has a life expectancy of 5.4 years, yet it is important to note that the United States today has the highest death rate in the world from accidents for persons over forty-five years of age. One-third of these accidents is found in the group sixty-five years of age and over.

In view of these statistics, it was felt mandatory that a basic plan be constructed to manage cases of trauma in the aged.

Briefly, it is of importance to note that many investigators consider that the aging process consists of an actual decrease in the elastic fibers throughout the body. This depletion gives the elderly patient a limited compensatory mechanism and therefore potentiates the difficulties in treating the aged, especially in times of stress [*31*]. Their decreased physical reserve is due primarily to changes in the three major systems: cardiovascular, renal and respiratory. A state of "chronic shock" is a frequent finding in the aged, allowing the patient to relapse into the acute shock stage with only minimal physical trauma.

The management of trauma in the aged may present a very difficult problem. It must be emphasized that in these persons stress has been applied before measures to withstand it can be taken.

However, by considering the facts previously mentioned many of the problems may be handled effectively.

Although each case must be handled individually, it is necessary to have a basic plan of management established. Such a plan has been developed and used in our hospital with thirty-five cases of trauma in persons sixty-five years of age and older: Table 1 shows the types of cases encountered. The plan is simple but it has been effective in producing adequate patient evaluation, preparation and replenishment. For best results it is suggested that either a house staff man or an attending man should act as coordinator and see that all the steps of the following plan are performed in an active and thorough manner:

Step one: The aged trauma victim is attended immediately and all emergency procedures such as hemostasis, management of shock and establishment of an adequate airway (including tracheotomy if necessary) are performed. Fluid and electrolyte management is started immediately.

Step two: A complete history is obtained and physical examination is made. The history often must be obtained from a relative and the cause of the accident must be ascertained, if possible. Knowledge of the patient's status prior to trauma is extremely important and gives warning of previously existing problems which may affect the course of management. The physical examination must be thorough and not just cover the obvious traumatized site.

Step three: At this point the initial evaluation of the patient should be made and the course of the treatment charted.

If emergency surgery need be performed as a life-saving procedure, the existing deficits must be estimated and corrected quickly. After surgery is completed the patient should be further evaluated and replenished. On the other hand, if surgery is not needed, or if when needed it can be delayed, the patient should be studied in more detail. In this manner the systemic deficits can be restored, if need be, in a more organized and intelligent way, thus preparing the patient for the second episode of trauma.

Step four: To evaluate the organ systems quickly, one laboratory procedure is performed on each of the major systems. The initial studies consist of: (1) complete blood count, (2) urinalysis, (3), blood urea nitrogen, (4), prothrombin time, (5), electrocardiogram, (6), chest x-ray and (7), blood sugar.

If any impairment is shown, other tests should be performed to note the intensity of the damage in the particular organ.

Other tests of value used in most cases were blood volume study, serum sodium, chlorides and potassium determinations, and eosinophil counts to note the patient's recovery response.

Correlating the results of these tests with the clinical findings produces a good picture of the patient in general. With this information it is possible to restore the patient's deficits correctly and enhance the healing of the traumatized site. If corrective surgery need be performed, it is now possible to evaluate and prepare the patient properly prior to this second episode of trauma.

The average time taken to complete these four steps is five to ten hours.

Many other points of management are exceedingly important and must be stressed.

Proved blood volume deficits should be replaced with whole blood. Reluctance to use transfusions for fear of overloading the system in the aged has been disproved [2,32,34]. Adequate blood replacement markedly reduces mortality and morbidity. The replacement should be done slowly, with not over 1 L. of blood per day being given and only 250 to 500 cc. per day if time permits.

During this time of flux the cardiac status must be watched closely. Frequently the use of digitalis and anticoagulants may be necessary.

Prophylactic antibiotics are used to defer the possibilities of infection, especially those of the respiratory tract.

Other simple procedures which reduce the chances of respiratory infection are early ambulation, respiratory exercises, clear airways, early removal of Levin tubes (if present), enhancement of excretions and relief of bronchospasm by the use of drugs, and the use of nerve blocks for fractured ribs to replace analgesics and sedatives.

Good renal function must be maintained. In the majority of cases this is accomplished through the use of correct fluids and electrolytes, good cardiac care and early ambulation. An indwelling catheter is often needed to air nursing care, relieve urinary retention and to obtain an accurate intake and output chart.

The use of parenteral salts and fluids are restricted following trauma. Rarely is more than 1,800 cc. to 2,000 cc. needed per day.

No saline is given on the day of trauma or for the first two to four days [57]; then 5 gm. of salt is given daily unless the patient is losing it by other means.

Potassium does not have to be given as the shift will usually correct itself. Care must be taken not to overload the system. If a potassium deficit is present it should be replaced over a two- to three-day period [22].

If the patient is badly dehydrated, the first 1,500 cc. can be given rapidly, but following this only 500 cc. per hour should be given.

Early ambulation enhances all steps of therapy and is the key point in low morbidity during the convalescent state. Leg, arm and breathing exercises should be made mandatory while the patient is at bedrest.

These patients are fed as soon as possible. A high protein diet must be used because in

TABLE I
TYPE OF INJURY IN THIRTY-FIVE CASES OF TRAUMA (PATIENTS SIXTY-FIVE YEARS OF AGE OR OLDER)

Types of Injury	No. of Patients
Generalized contusions, lacerations, unconsciousness, minor fractures	5
Hip fractures	22
Elbow fractures	1
Humeral fractures	3
Tibial fractures	1
Femoral fractures	1
Vertebral fractures	1
Multiple severe rib fractures	1
Total	35

times of stress two to three times the normal amount of protein is needed [38]. Intravenous feedings of 100 gm. of glucose should be supplied daily to give protection against the loss of proteins when food is not being taken orally.

Multiple vitamin capsules and supplementary feedings given between meals and at bedtime add much toward better nutrition.* Therapeutic doses of insulin and thyroid may be used as appetite stimulators.

Small doses of drugs, especially sedatives, should be used in these aged people. The combined use of sedatives and analgesics in small doses yields good results with less generalized depression.

It is important to attend and observe these people daily. A kind, cheerful and understanding approach to overcome their frequent depressive states and aid in their rehabilitation must be used.

EVALUATION OF CLINICAL WORK

The trauma plan was used on thirty-five aged accident victims admitted to the hospital consecutively. (Table I.) These patients had a total of 380 hospital days, or an average of 10.5 days per patient. There was one death, giving a mortality rate of 2.85 per cent. In this patient death occurred after fulminating pseudomembranous enterocolitis developed.

* The supplementary feeding used consisted of 30 gm. of powdered skimmed milk in a glass of skimmed milk flavored with chocolate or vanilla. This produces 18 gm. of proteins and 26 gm. of carbohydrates per glass.

TABLE II
HIP FRACTURES IN PATIENTS AGED SIXTY-FIVE YEARS OR OVER

	No. of Cases	No. of Hospital Days
Immediate surgical repair	50	1,053 (av., 21.06)
Trauma plan used prior to surgical repair	22	260 (av., 11.81)

By the use of the plan presented, a more complete evaluation was accomplished in these patients, thus discovering a large percentage of concomitant disease. (Table III.) Cardiac disease (57.1 per cent), urinary tract disease (37.1 per cent), generalized arteriosclerosis (40 per cent) and hypertension (25.7 per cent) were the four major entities found.

A low percentage of complications was encountered in this group of cases. (Table IV.) Fever (above 100°F. for three days) was noted in three patients, pneumonitis in one, upper respiratory tract infection in one, and uncontrolled diabetes in one.

For comparison and further evaluation of the trauma plan, fifty additional case histories were reviewed. These patients were sixty-five years of age and older, chosen at random from admissions during the two years immediately prior to the institution of the trauma plan. They had all had immediate repair of traumatic hip fractures without the benefit of complete preoperative work-up and preparation.

This group of non-trauma plan patients had a total of 1,053 days of hospitalization, or an average of 21.06 days per patient. Three deaths occurred in this group of fifty patients, producing a 6 per cent mortality.

Table III shows the low percentage of concomitant disease found in the group not managed by the trauma plan. By reviewing Table IV the long list of complications encountered in this group can be noted.

The value of this proposed plan can be further appreciated by the comparison of these two groups.

The non-trauma plan group of fifty patients with hip fractures had an average of 21.06 days of hospitalization per patient. The twenty-two patients with hip fractures who were operated

TABLE III
PREVIOUSLY EXISTING ASSOCIATED DISEASE NOTED BY STUDIES

Disease	Trauma Plan Not Used (50 Cases)		Trauma Plan Used (35 Cases)	
	No. of Cases	Per cent	No. of Cases	Per cent
Hypertension	10	20	9	25.7
Cardiac disease	19	38	20	57.1
Diabetes mellitus	5	10	3	8.57
Pulmonary disease	2	4	9	25.7
Urinary tract disease	6	12	13	37.1
Liver disease	0	0	2	5.7
Generalized arteriosclerosis	5	10	14	40
Deafness	0	0	3	8.57
Arthritis	2	4	6	20
Syphilis	0	0	1	2.57
Carcinoma of rectum	0	0	1	2.57

upon and treated by the trauma plan had a total of 260 days of hospitalization, or an average of 11.81 days per patient, therefore decreasing the hospital stay per patient almost 50 per cent. (Table II.)

Three deaths occurred in the fifty patients not included in the trauma plan, and one death was encountered in the trauma plan group.

By the use of the plan, a large percentage of concomitant disease was revealed. (Table III.) It is believed that patient management was greatly enhanced by the knowledge of these associated diseases. The low percentage of concomitant disease found in the non-trauma plan cases is the result of the non-systematized cursory examination and is thought to be a major factor in the production of the long list of complications that occurred in this group. (Table IV.) The low percentage of complications found in the patients treated by the trauma plan is believed to be directly proportional to the method of management used.

CONCLUSIONS

The total results obtained by the use of the trauma plan have been good. Good wound healing was encountered, the patients responded to blood replacement well and the postoperative period was uneventful in the majority of cases.

The aforementioned statistics show that by the use of such a plan the days of hospitalization are reduced almost 50 per cent. Better

TABLE IV
COMPLICATIONS

Complications	No. of Cases
Trauma plan not used (50 cases):	
Fever (above 100°F. for three-day period)	10
Incarcerated hernia	1
Decubitus ulcers	2
Pyelitis	3
Cerebral vascular accident	2
Cerebral vascular spasm	1
Cystitis	1
Shock	2
Thrombophlebitis	2
Congestive heart failure	2
Wound infection	1
Pneumonitis	2
Pulmonary embolus	1
Trauma plan used (35 cases):	
Fever	3
Temperature to 102°F. following transfusion	1
Upper respiratory tract infection with pharyngitis	1
Uncontrolled diabetes	1
Pneumonitis	1
Pseudomembranous entercolitis	1

patient management is possible, therefore decreasing the frequent geriatric complications greatly.

Many of these patients are in better health today because of follow-up therapy for a debilitating disease discovered through the use of the trauma plan. It has shown that judicious delay and careful preparation for surgical correction of the effects of trauma result in far better care of the aged accident victim.

The plan has met with the administrative approval of the staff at this hospital. It is believed that such a plan could be used in any type hospital and would be of great value in the management of the elderly trauma victim.

SUMMARY

With the geriatric population increasing, the rate of accidents and trauma is also increasing in this age group.

Management of the aged trauma victim is often difficult. Many of the management problems can be effectively handled, however, by knowing the aging factors. A summary of these changes in the aged is presented.

A simple plan for evaluation and management of the elderly trauma patient is outlined. A series of thirty-five elderly trauma victims is presented showing the results of their treatment by the trauma plan.

A comparative study was made to evaluate further the functional value of the trauma plan. It is believed that in light of the statistics presented, this plan is of value and an adjunct to any hospital in the management of the aged trauma victim.

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Herniorrhaphy in an Advanced Age Group

ANALYSIS OF 300 CASES

ARKELL M. VAUGHN, M.D., MICHAEL S. WHITE, M.D., CORNELIUS M. ANNAN, M.D., JOHN A. CASERTA, M.D. AND JOHN M. COLEMAN, M.D., *Chicago, Illinois*

From the Departments of Surgery and Medicine, Stritch School of Medicine of Loyola University, and Mercy and Cook County Hospitals, Chicago, Illinois. Presented before the Chicago Surgical Society, January 3, 1958.

THE material for this presentation consists of 300 operations for hernia, principally inguinal, performed upon patients over sixty to ninety-five years of age who were on the authors' Surgical Services at Mercy and Cook County Hospitals in Chicago over a five-year period. It represents an addition of eighty-six patients with hernia in this age group since the previous series reported by two of the present authors, Vaughn and White [1] in October, 1957.

Our chief purpose here is to show the good results in these 300 surgical patients, particularly those who were seventy to ninety-five years of age, and to emphasize that the majority of the herniorrhaphies were elective. This is an important feature in a group such as this, for while the question of elective operations upon patients of any age is always a delicate decision for the physician and surgeon, it is a doubly difficult one in dealing with older patients.

We must, however, be increasingly cognizant of the constantly growing need for such decisions because of man's lengthening life span. This is especially so in relation to hernia, one of the most common surgical conditions found in these persons. Furthermore, the fact is becoming more evident that chronologic age alone is not a prime deterrent to elective surgical procedures.

Results of the present series, as will be illustrated, bear out the growing opinion among those interested in geriatrics that patients in an operable condition, regardless of the decades which have passed them by, can tolerate many types of moderate major operations, such as herniorrhaphy, with morbidity and mortality rates not too dissimilar to those in younger patients. This, in great part, is attributable to our improved methods of pre- and postoperative care, including measures for maintenance of electrolyte balance, blood replacement, antibiotics and other safeguards, and our advanced operative technics.

We believe there are three important reasons for performing elective herniorrhaphies upon the older patient: (1) alleviation of suffering and discomfort, (2) prevention of surgical emergencies with their implied complications which the elderly patient cannot tolerate too well, and (3) the availability of sufficient time before an elective operation for a thorough work-up, ample preoperative preparation, and corrective and supportive measures so important to the elderly patient.

SURGICAL RISK

When we hope for a clearly defined answer in determining the good or poor risk patient for any elective surgical procedure in the elderly, we have little choice. We know that when confronted with an aged patient with a surgical condition, there is the inherent, usually well founded suspicion of other superimposed pathologic conditions or degenerative disease processes, nutritional, hematologic and other deficiencies, and usually a diminished physiological reserve. This was apparent in our large number of indigent patients at Cook County Hospital. In an article on problems encountered in general surgery of the aged, this subject was discussed by Vaughn, White and Coleman [2], and included the following statement which we believe bears repeating:

TABLE 1
NUMBER OF ELECTIVE AND EMERGENCY OPERATIONS

	No. of Patients	Elective Operations	Emergency Operations
Patients aged 60 to 70 yr.:			
Mercy Hospital	82	80	2
Cook County Hospital	103	97	6
Patients aged 70 to 80 yr.:			
Mercy Hospital	32	28	4
Cook County Hospital	69	64	5
Patients aged 80 to 95 yr.:			
Mercy Hospital	4	3	1
Cook County Hospital	10	7	3
Totals	300	279	21

"When major elective surgery is anticipated on an elderly patient, the available time should be judiciously used in a careful evaluation, physical examination, and laboratory studies; and in certain circumstances, in consultation with an internist. Such analysis of the preoperative condition of the elderly patient whenever possible, pays great dividends in improving operability. Close attention to details such as preoperative build-up, and preoperative correction of any correctable complications, is nowhere so important and rewarding as in the elderly, for these concurrent diseases and deficits rival postoperative complications as a cause of operative mortality in aged patients."

While we are still of this opinion, we agree with the growing conviction among some surgeons that whether or not certain coexisting disease is preoperatively correctable in older patients, herniorrhaphy can and should be accomplished electively whenever possible. This theory was corroborated in our present series, for while chronic infection seemed to have an effect in retarding recovery of these patients, concurrent benign disease, including chronic pulmonary or renal disease refractory to preoperative correction, had little effect on the mortality rate.

We concur with Parsons et al. [3] that operation be performed on aged patients with benign disease in which complications tend to occur. They pointed out that "The patient with benign disease may live the remainder of his life with no more trouble than he is presently having from it. He may lose his life if he is operated on electively, for some fatalities are inevitable in all surgery, however good the risk. But he may also lose his life, or come close to losing it, if complications develop and emergency operation is required." This is particularly pertinent to hernias in the aged, in whom elective operations are losing their previous hazard, and to a condition in which a high potential of surgical emergency exists with its aspect of fright and sense of hopelessness in the elderly patient.

Therefore, we continue to emphasize the fact that many elderly patients are still unnecessarily denied elective surgical repair of hernias because of age, apprehension regarding surgical risk, and the belief that the older patient has a greatly lessened capacity to recover from operation. As Cole [4] has stated, "Too often surgical therapy for elective conditions is postponed in elderly patients, in the hope I presume, that the patient will die of some other disease before the present one threatens his life."

STATISTICS OF PRESENT SERIES

There were 118 patients at Mercy Hospital and 182 at Cook County Hospital, 259 males and forty-one females. In the age group from sixty plus to seventy years there were 185 patients; there were 101 in the seventy to eighty year age group, and fourteen patients were eighty to ninety-five years of age.

We performed 279 elective operations in the series and twenty-one emergency procedures. Surgical emergencies included eight patients in whom operative intervention was contraindicated for various reasons but herniorrhaphy was mandatory as a life-saving procedure.

The number of patients in each age group, the hospital in which the operation was performed and the number of elective and emergency procedures at each are shown in Table 1.

There was a total of 272 inguinal hernias in the series: 158 in the group of patients sixty plus to seventy years of age, 101 in the seventy to eighty year age group and fourteen in the group of patients eighty to ninety-five years of age. There were thirteen ventral, four femoral, eight umbilical and two postoperative incisional hernias in the sixty plus to seventy year age group, and one postoperative incisional hernia in the group of patients seventy

to eighty years of age. In some patients two or more types and sites of hernia existed and were cared for.

Of the inguinal hernias, fourteen were bilateral, twenty-five recurrent, seven strangulated and eighteen incarcerated (three with small bowel obstruction). There were also two incarcerated ventral hernias with small bowel obstruction. In the group of patients who were eighty to ninety-five years of age, four had incarcerated hernias (one with bowel obstruction and two with strangulation). One of these patients was eighty-seven years of age; one, ninety; and one, ninety-five; as will be seen later, all survived.

One patient in the series had a strangulated indirect inguinal hernia with partial gangrene of the ileum. Operation was entirely successful and the period of morbidity minimal. Resection of a portion of bowel was necessary in six patients; in some, hydrocelectomy was performed in addition to herniorrhaphy.

ANESTHESIA AND OPERATION

The choice of anesthesia is always one of selectivity and is governed by many factors, including age, blood pressure and cardiac status, and other systemic and psychological evaluations. Of primary importance in the elderly, however, is the status of the upper respiratory region prior to operation, because of the susceptibility of these patients to the deleterious effects of hypoxia and anoxia. That the choice of anesthesia and its interdependence upon the preoperative condition, particularly of an elderly patient, is of great import was demonstrated by the types of anesthesia which we found indicated and sometimes necessary in our series, especially in those patients at Cook County Hospital.

For example, general anesthesia was administered to ninety-eight of the 118 patients at Mercy Hospital compared to eighty-five of the 182 at Cook County Hospital. Spinal anesthesia was given to sixteen private patients with respiratory and other diseases, whereas it was deemed necessary in seventy-four of the patients at Cook County Hospital. Local anesthesia was given to only four of the patients at Mercy Hospital but was essential in twenty-three of the patients at Cook County Hospital.

There are many well known, satisfactory methods of operation employed in herniorrhaphy, and as many different modern modifications of the old accepted operative procedures. It is the selection of a procedure which, in the surgeon's hands, has proved most satisfactory for a specific situation. We cannot be dogmatic in suggesting the superiority of one technic over another for all patients and to all surgeons. In this regard, and especially when thinking of the selection of an operative technic for herniorrhaphy in an aged patient, we like the reference made by Koontz [5]. He stated that "the late Dr. J. M. T. Finney was often heard to say, 'Make the operation fit the patient. Don't try to make the patient fit the operation.'"

In the majority of both direct and indirect inguinal hernias in the present series, we employed the Halsted modification of the Bassini operation. In some of the Halsted procedures we have observed an occasional recurrence at the point where the cord emerges from the peritoneal cavity at the new internal and external rings. We prefer the Halsted modification, as especially suited to the repair of direct and indirect inguinal hernias in older patients, because we have observed fewer recurrences with this procedure. As a matter of fact, we usually use this method in all but the very young patients in whom we frequently employ the Bassini technic.

One yardstick for our choice of the Halsted modification of the Bassini operation is the fact that one of us (A. V.) has used this procedure for over twenty years on patients he has been able to follow up over a long period of time, and if recurrences occurred they were personally observed.

In the ventral and umbilical hernias we employed the Mayo technic of repair. In the femoral hernias, understandably, the operation was dependent upon the magnitude of herniation. The small femoral hernias required a simple repair from below, while the larger ones were approached from above, simulating and sometimes exceeding the type of repair required for an inguinal hernia.

One factor in the present series was identical with that in our previous report [1]. While, in the main, the technic of operation was, as a rule, executed in the conventional manner, variations or modifications were often necessary to fit the need of the individual patient. It was essential that repair of the hernias in these aged individuals be practicable from

TABLE II
POSTOPERATIVE COMPLICATIONS

Age of Patients	No. of Patients		Complications*	
	Mercy Hosp.	Cook County Hosp.	Mercy Hosp.	Cook County Hosp.
60 to 70 yr.	82	103	Pulmonary embolism, 2† Atelectasis, 2† Bronchitis, 1 Pleurisy with effusion, 1 Wound abscess, 3 Pneumonia, 1 Cerebral vascular accident, 1	Pneumonia, 1 Myocardial infarction, 1† Uremia, 1† Urinary retention, 1 Electrolyte imbalance, 2 Pleurisy with effusion, 1 Wound infection, 3 Scrotal swelling, 3
70 to 80 yr.	32	69	Subarachnoid hemorrhage, 1 Prostatic complication, 1 Myocardial infarction, 1†	Cystitis, 1 Atelectasis, 1 Bronchiectasis, 1 Urinary retention, 1 Bladder infection, 3 Thromphlebitis, 1
80 to 95 yr.	4	10	.....	Wound infection, 1

* Total complications, thirty-seven (12.3 per cent).
† Deaths resulting from the complication.

the standpoint of existing or potential tensile tissue strength, life expectancy and amount of physical exertion or activity that could be expected or be necessary in the patient's future. In bilateral direct and indirect inguinal hernias, particularly in the older patient, we prefer to do only one side at a time.

Considerable multiplicity of opinion exists regarding choice and efficacy of certain suture materials for use in hernia repair. This is evidenced in reports in the literature on the pros and cons of catgut, silk, cotton, fascia, steel wire mesh and tantalum mesh. We believe there is a place for each of these materials. In the recurrent inguinal hernias in this series of elderly patients, and particularly in those with weakened tissue, we sometimes used tantalum or steel wire mesh as a graft into Hesselbach's triangle. We rarely do fascial transplants unless specifically indicated.

RESULTS

Complications. Postoperative complications were encountered in thirty-seven patients in the series: twenty-five in the patients sixty plus to seventy years old, eleven in the seventy to eighty year age group, and one in the group of patients eighty to ninety-five years of age. The type of complicating disorder which occurred was to be expected in a series of older patients. What makes the small over-all number of postoperative complications unusual is the poor or only fair preoperative condition of many of the very elderly patients on admission, primarily for elective herniorrhaphies. This was markedly true in those patients at Cook County Hospital whose socioeconomic background implied, and usually demonstrated, a lowered nutritional status and diminished physiological reserve.

Another unusual feature in the present series, and also noted in our previous series of herniorrhaphies in the aged, was the fact that the highest percentage of postoperative complications occurred in those patients in the age bracket from sixty plus to seventy years. Likewise, while very few cases of prolonged morbidity were prominent in the entire series, many of those that did occur were in this younger age group. Noteworthy also was the fact that there were only three cases of postoperative atelectasis and one case of pneumonia in this entire group of elderly patients. Table II presents the number, per-

TABLE III
DEATHS AND MORTALITY PERCENTAGES

	No. of Patients		No. of Deaths		Mortality (%)
Patients aged 60 to 70 yr.:					
Mercy Hospital	82		4		4.9
Cook County Hospital	103		2		2.0
		185		6	
Patients aged 70 to 80 yr.:					
Mercy Hospital	32		1		3.0
Cook County Hospital	69		...		...
		101		1	
Patients aged 80 to 95 yr.:					
Mercy Hospital	4		...		...
Cook County Hospital	10		...		...
		14			
Totals		300		7	2.3

centage and types of postoperative complications, and indicates those which were the cause of death.

Mortality. There were only seven deaths (2.3 per cent) in the series: five after elective operations and two after surgical emergencies. There were no deaths among the patients in the eighty to ninety-five year age group, and only one death in those patients seventy to eighty years of age. Again, it is a notable feature that most of the untoward results and percentage of deaths in the series occurred in the sixty plus to seventy year age group, the older patients giving a remarkably good account of themselves. As most of the operations were elective, this negates the theory that chronologic age alone is a contraindication to herniorrhaphy as an elective procedure. The importance of modern antibiotics and their vital role in postoperative care, especially of the older surgical patient, was demonstrated in our series by the fact that there were no deaths from pneumonia. The number of deaths and mortality percentages in each age group are shown in Table III.

Results of the series, particularly those in the advanced age group of patients who were seventy to ninety-five years of age, illustrated the fact that, if properly cared for, these elderly surgical patients should survive moderate major surgery. Furthermore, in weighing the merits of elective herniorrhaphy in the aged patient against the disadvantages, we seem to find the advantages increasingly ahead.

COMMENTS

In attempting to reduce the occurrence of surgical emergencies and complications in hernia, one fact is paramount—the public is not aware of the importance of early hernia repair and must be educated in this regard. The elderly individuals especially, and their families, should be urged to seek consultation with their physician or surgeon when symptoms of hernia appear and certainly when they begin to evidence discomfort. If they are told about the untoward effects that can occur because of reluctance and delay in caring for this condition, and the good results to be obtained in prompt and early attention to hernia and its symptoms, our mortality rate of herniorrhaphy will continue to show improvement.

Etiology of the hernias in our series of elderly patients was that found in any age group. The patients included men and women from all walks of life and with differing living habits and environments. They were variously employed or otherwise active in business, had household and other duties or were semi- or entirely inactive. The literature on the etiology of inguinal and femoral hernias often includes mention of the term traumatic. However, from our experience, and particularly in the present series, this would seem to constitute a large question mark with regard to etiological determination. Results of our study substantiate the theory held by some physicians and surgeons that trauma as a cause is not an important factor, and is conjectural even in young patients with hernias in the inguinal and femoral regions. Nevertheless, further study into traumatism as a cause may be warranted.

In our previous articles [*1,2*] we have discussed preoperative preparation and the postoperative care and ambulation of the elderly patient. However, in our opinion, repetition of two points of interest seems pertinent. The first is that the niceties of postoperative care in herniorrhaphy of the aged patient is of vital importance. The moving and handling of these patients in the immediate postoperative period calls for more than ordinary routine

caution. We agree with Oberhelman [6] who stated in discussing surgical problems of the aged that "This period begins the moment the surgeon has tied his last knot. Unless the patient's general condition is good, he should under no circumstances be moved from the operating table to the transport cart until his general condition warrants it. Furthermore, when such a patient is moved, he must be lifted most gently from the operating table to the cart and then from the cart into the hospital bed."

The second point deserving re-emphasis is that judicious, cautious selectivity in postoperative ambulation of the aged patient is essential. We realize the attributes of early ambulation in older patients to avoid conditions such as phlebothrombosis, pulmonary embolism and other respiratory complications, yet we must take into consideration such factors as the strength and condition of the tissues in the aged patient and his natural tendency toward anemia, weakness, malnutrition, cardiac decompensation and arterial degeneration. The surgeon must impose his own rules in the postoperative care and ambulation of his elderly patient.

SUMMARY

An analysis is presented of 300 herniorrhaphies, principally elective, performed upon a series of patients in an advanced age group. Emphasis is placed upon the fact that the older patient should not, as a rule, be denied elective hernia repair on the basis of chronologic age alone.

Statistics are presented which demonstrate that even those patients of very advanced age withstand operative hernia repair with few complications and an extremely low morbidity rate.

It is stressed that avoidance of complicated emergency herniorrhaphies in the elderly can and should be accomplished by early care of their hernias and by education of the public in this regard.

The importance of the choice of anesthetic agent for elderly patients and its interdependence upon their preoperative condition is discussed. Figures on the types of anesthesia indicated and administered in the series substantiate this relationship.

The small number of deaths in the series illustrates the growing contention that the aged patient, in an operable condition, can tolerate moderate major surgery, such as herniorrhaphy, with a mortality rate not far removed from that of younger patients.

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The Effect of d-Pantothenyl Alcohol upon Postoperative Discomfort

A DOUBLE BLIND STUDY

C. E. HAYCOCK, M.D., *Brooklyn, New York,* W. A. DAVIS, M.D., *Glen Ridge, New Jersey,* AND T. V. MORTON, JR., M.D., *Glen Ridge, New Jersey*

From St. Barnabas Medical Center, Newark, New Jersey.

PANTHENOL* (d-pantothenyl alcohol), the alcohol derivative of pantothenic acid, is believed to be a precursor of acetyl choline through its incorporation into co-enzyme A. Pantothenic acid belongs to the vitamin B group and is thought to be essential for human nutrition.

A pantothenic acid–deficient diet fed to dogs produces a syndrome which includes nausea, vomiting, a 50 per cent decrease in gastrointestinal motility and 40 to 60 per cent diminution in rates of carbohydrate and protein absorption [1]. In rats the deficiency led to distention of the bowels, which were filled with many gassy bubbles and had lost all peristalsis. In many of these rats duodenal ulcers also developed, according to Zucker who reports a state of sensitization or increased vulnerability of tissues to cortical hormone in pantothenic acid–deficient rats, due apparently to the low availability or co-enzyme A [2]. The addition of pantothenic acid to the diet before the death of these animals caused all symptoms to disappear [2,3]. No similar syndrome has been demonstrated in man since human disease syndromes are generally associated with a deficiency of the entire B complex.

Jacques [4] in England first demonstrated the clinical use of pantothenic acid for the treatment of paralytic ileus. He used calcium pantothenate (50 mg. intramuscularly every three hours) with dramatic results. His work has since been duplicated by Banerji in India [5], Bergman [6] in the United States and Docherty in Ireland [7].

* Panthenol® supplied by Roche Laboratories, Division of Hoffmann-La Roche, Nutley, New Jersey.

Felten [8] in Germany used injections of 500 mg. of panthenol in fifty cases of postoperative gas pains and constipation. These patients had not responded to the usual enemas, prostigmin, etc., but a full paralytic ileus had not developed. He reported very effective results. Banerji in India, Zutelman [9] in Argentina and Hofmann [10] in Brazil also reported the use of the drug postoperatively for abdominal distention with good results.

Based on the aforementioned evidence, we believed that a "double blind" study of the effect of panthenol in patients after abdominal surgery was indicated.

METHOD OF STUDY

The double blind study was conducted on 100 patients who had undergone abdominal surgery. Ampuls of clear solution labeled "panthenol A" and "panthenol B," one of which consisted of physiological saline and the other containing 250 mg./ml. of panthenol, were used.

The author conducting the clinical evaluation of patients was unaware of which ampuls contained the active ingredient. The solutions were administered intramuscularly to two groups of patients, one getting the "A" preparation, and the other receiving the "B" preparation.

A dose of 500 mg. was given on the day of surgery and 250 mg. twice daily thereafter for five days.

Patients were examined twice daily and symptoms and signs graded 1+ to 4+ depending on severity. Observations were recorded on charts. (Fig. 1.)

Auscultation of the abdomen for presence of

PANTHENOL TYPE: A STUDY NUMBER: 99

NAME: P.W. AGE: 52 SEX: M HOSPITAL NO. --

DIAGNOSIS: SIGMOID POLYP

OPERATION: ANTERIOR RESECTION SIGMOID COLON FOR POLYP

LENGTH: 2½ (hrs.) ANESTHETIC: PENTOTHAL, N_2O, O_2 $(C_2H_3)_2O$, ANECTINE 1%

Date 1957	7/12	7/13		7/14		7/15		7/16		7/17									
Day	1	2		3		4		5		6		7		8		9		10	
	(Oper)	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm	am	pm
Highest Temperature	98^8	98^6	99^8	97^6	99^8	98^6	99	98^6	99	98^6									
M. S. (gr.)	-	-	-	-	-	-	-	-	-	-									
Demerol (mg.)	100	-	-	100	-	-	-	-	-	-									
Barbit. (gr.)	-[1]	-	-	-	2	-	-	1½	-	-									
IV Fluids(liter)	2.5	1	1	1	1	1	-	-	-	-									
Panthenol (cc)	2	1	1	1	1	1	1	1	1	-									
Enema	-	-	-	-	-	-	-	-	-	-									
Laxative	-	-	-	-	-	-	-	-	-	-									
Ambulatory	-	-	-	+	+	+	+	+	+	+									
Apathy	+++	+	-	-	-	-	-	-	-	-									
General Discomfort	++++	+++	+++	+++	++	++	+	+	-	-									
Nausea	+++	-	-	-	-	-	-	-	-	-									
Vomiting	+	-	-	-	-	-	-	-	-	-									
Abdominal Distention	-	+	+	-	-	-	-	-	-	-									
Abdominal Tenderness	++++	+++	+++	+++	++	++	+	+	-	-									
Active Bowel Sounds	+	++	+++	++++	++++	++++	++++	++++	++++	++++									
Passed Flatus	-	-	+	+	+	+	+	+	+	+									
Bowel Movement	1 pre-op.	-	-	1	1	-	1	1	-	-									

FIG. 1.

bowel sounds was carried out in four quadrants for one minute each. At the completion of the series of 100 patients, the forms were submitted for statistical analysis by professional statisticians.

Fischer's "T" test of significance was used to match the group receiving the actual drug (group A) against the placebo group (group B). (Table 1.)

In all the patients used in the study the peritoneal cavity had been opened; the majority were female. The age varied from seven years to eighty-three years. The types of surgical cases are noted in Table II with the sex distribution.

A significant difference is present when the P value is found to be less than .05, that is, when the occurrence happens by change less than five times of 100 trials. By this method, a value of $P < .01$ was obtained for distention and $P < .01$ for the bowel sounds, indicating definitely less distention and quicker restoration of bowel sounds in the "A" group. The nausea factor was difficult to evaluate as it was noted for a matter of hours rather than days, but to the observer there was definitely less vomiting in the "A" group. The expulsion of flatus had a P value of 0.6, but the observer noted that this was a subjective sign and was probably not accurate in consideration of the absence of distention in these patients.

In several instances the same patients received the drug twice for successive operations. A total of seventeen patients with postoperative ileus were also treated with the actual drug during the course of this study with good results. An unusual case will be reported which at first glance represented a failure of the drug and is so recorded, but which actually proved the drug to be effective.

TABLE I
RESULTS OF FISCHER'S "T" TEST OF SIGNIFICANCE

Factors	"A" Group	"B" Group*
Age	T = 1.57	P = <0.1
Distention	T = 6.1	P = <0.01
Length of operation	T = 0.99	P = >0.3
No flatus	T = 0.625	P = >0.6
Peristalsis	T = 4.47	P = <0.01

* A significant difference is present when P < 0.05.

TABLE II
SUMMARY OF TYPES OF SURGICAL CASES USED IN STUDY

Operation	Males	Females
Cholecystectomy	3	23
Subtotal gastrectomy	4	2
Gynecological surgery	..	47
Colon resections	1	3
Enterocolostomy	..	1
Colostomy	1	2
Endarterectomy	1	..
Reduction of an intussusception	..	1
Laparotomy with lysis of adhesions	..	2
Appendectomy (perforated appendix)	2	2
Repair of hiatus hernia and resection of diverticula	..	1
Repair of ventral hernia and lysis of adhesions	1	1
Presacral neurectomy	..	1
Totals:	13	87

CASE REPORT

L. G., a sixty-three year old white man, entered the hospital on April 9, 1957, with a diagnosis of rectovesical fistula as a result of an acute diverticulitis with abscess formation. It was believed that a diverting colostomy was indicated followed by later resection of the sigmoid colon and closure of the fistula.

On admission the patient's general physical condition was good with the exception of the rectovesical fistula; hence there was an elevated white blood cell count of 17,000 per cu. mm. with the presence of white cells in the urine.

Eight days after admission transverse colostomy was performed under general anesthesia. The postoperative course was routine with the exception of considerable abdominal distention and vomiting. The insertion of a Levin tube was required to gavage the stomach for two days postoperatively. The colostomy functioned well and one month after admission sigmoidoscopy and cystoscopy showed improvement of the diverticulitis and cystitis.

Seven weeks after admission a prolapse of the defunctionalized portion of the bowel occurred which could not be replaced because of an obstructing adhesive band of skin. The patient was taken to the operating room four days later and the band of skin was incised, the bowel was replaced and a skin flap swung to cover the defect between the loops of bowel.

The patient made rapid progress following this procedure. The white blood cell count and urinalysis remained normal and it was believed that the patient was ready for the second stage procedure. Resection of the diseased portion of the sigmoid colon was performed, separating it from the posterior portion of the bladder wall. This was done without difficulty two months after the initial surgery.

Postoperatively the patient was given 500 mg. of panthenol "A" at 6:00 P.M. on the day of surgery and 250 mg. twice a day (6:00 A.M. to 6:00 P.M.) for five days. Although good peristalsis was heard, the patient became markedly distended postoperatively with acute gastric dilatation developing requiring insertion of a Levin tube. He remained distended through the fourth postoperative day when he began passing some flatus. The Levin tube was removed. On the sixth postoperative day he became distended again and a Miller-Abbott tube was passed well into the small bowel. By the tenth postoperative day we were able to remove the tube and the patient began having normal bowel movements through the colostomy although he required frequent enemas. This apparently represented a failure of the panthenol.

Three months after initial surgery the patient was returned to the operating room for closure of the colostomy. During surgery it was found that the distal colon was completely obstructed by adhesions and a portion had to be resected. Also adherent to this area of obstructed transverse colon were several loops of small bowel which were evidently partially obstructed. This explained the previous poor postoperative course. The colostomy was closed following resection of the obstructed distal portion.

Postoperatively the patient was placed on the known drug. He was given 500 mg. of panthenol intramuscularly the day of surgery and this was continued once daily for five days. On this occasion the patient had excellent peristalsis and only slight one-day distention. He began passing flatus per rectum the second day postoperatively. He had a bowel movement on the third postoperative day with no vomiting or nausea after the first twenty-four hours postoperatively. The patient was discharged in good condition.

COMMENTS

It is apparent in this case that the seeming failure observed in the patient actually was due to a mechanical obstruction and that he had an excellent response to panthenol following the final surgical procedure.

It was the general impression of the observer that the drug was definitely effective and valuable in the postoperative care of patients undergoing abdominal surgery when there was any possibility of postoperative ileus developing. At the end of the study the difference in the "A" and "B" groups was obvious enough for the observer to identify easily which was the true drug and which was the placebo.

SUMMARY

We have presented a double blind study of 100 operative cases in which the drug panthenol was employed with the intention of reducing postoperative distention, nausea and vomiting and increasing peristalsis. The fifty patients receiving panthenol were shown statistically to have undergone a more benign postoperative course than those receiving the placebo. The drug has proved to have a significant effect in the reduction of postoperative nausea and distention and in the restoration of normal peristalsis.

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Carcinoma Arising in Minor Salivary Gland Ducts of the Lower Lip

RICHARD A. KEFFLER, M.D., *Lubbock, Texas*, NORMAN LENSON, M.D. *Boston, Massachusetts*, AND SHELDON C. SOMMERS, M.D., *Boston, Massachusetts*

From the Departments of Pathology and Surgery, Massachusetts Memorial Hospitals, Boston; and the Laboratory of Pathology, Pondville Hospital (Massachusetts Department of Public Health), Walpole, Massachusetts.

CARCINOMA of the lip is a relatively common tumor which usually has a favorable prognosis. We were impressed, therefore, with a case (patient E. F.) in which there was a rapid and fatal termination. Detailed microscopic study showed the presence of a histologically distinctive tumor, and re-evaluation of 140 cases of cancer of the lower lip, previously classified as epidermoid carcinoma, disclosed five additional cases of carcinoma of the minor salivary gland ducts.

PATHOLOGY

These tumors grossly resemble ordinary epidermoid carcinoma of the lip. (Fig. 1.) Microscopically, however, the carcinomas arise from the mucous membrane surface of the lip without transitional changes of the adjacent stratified squamous epithelium of the lip surface. The carcinomas grow in diffuse epithelial sheets containing poorly formed ductules with occasional gland formation. The cells are of variable size, closely packed and polygonal, with eosinophilic cytoplasm and hyperchromatic moderately pleomorphic nuclei. Mitoses are rather abundant. The majority of cells are poorly differentiated. Cytoplasmic vacuolization and suggestions of abortive secretions are frequent, but no mucous component can be identified using the PAS stain. (Figs. 2 and 3.) Rare keratin pearls and cell nests are found. Some of the cases could be classified as adenoacanthomas, except for the predominance of the undifferentiated glandular patterns of growth. (Figs. 4 and 5.) These tumors invade deeply, and infiltrate striated muscle and adjoining minor salivary glands. Lymphatic invasion occurs relatively often, but blood vessel invasion is rarely seen.

MATERIALS AND METHODS

Stimulated by finding Case 1, we reviewed the microscopic slides of 140 cases of cancer of the lower lip excised at Pondville Hospital from 1936 to 1949. No selection of cases was made, except that following the study of the first 100 cases of cancer of the lower lip, forty additional cases originally classified as epidermoid carcinoma grades 2 and 3 were re-examined. In the first 100 cases reviewed, four cases of carcinoma of the minor salivary gland ducts were noted, and in the second group of forty, one additional case of duct cancer was found.

All cancers had been excised at least five years before review, and the microscopic slides were available for study. Routine hematoxylin and eosin stains had been employed, and sub-

FIG. 1. Case 1. Clinical appearance of cancer of minor salivary gland duct indistinguishable from epidermoid carcinoma.

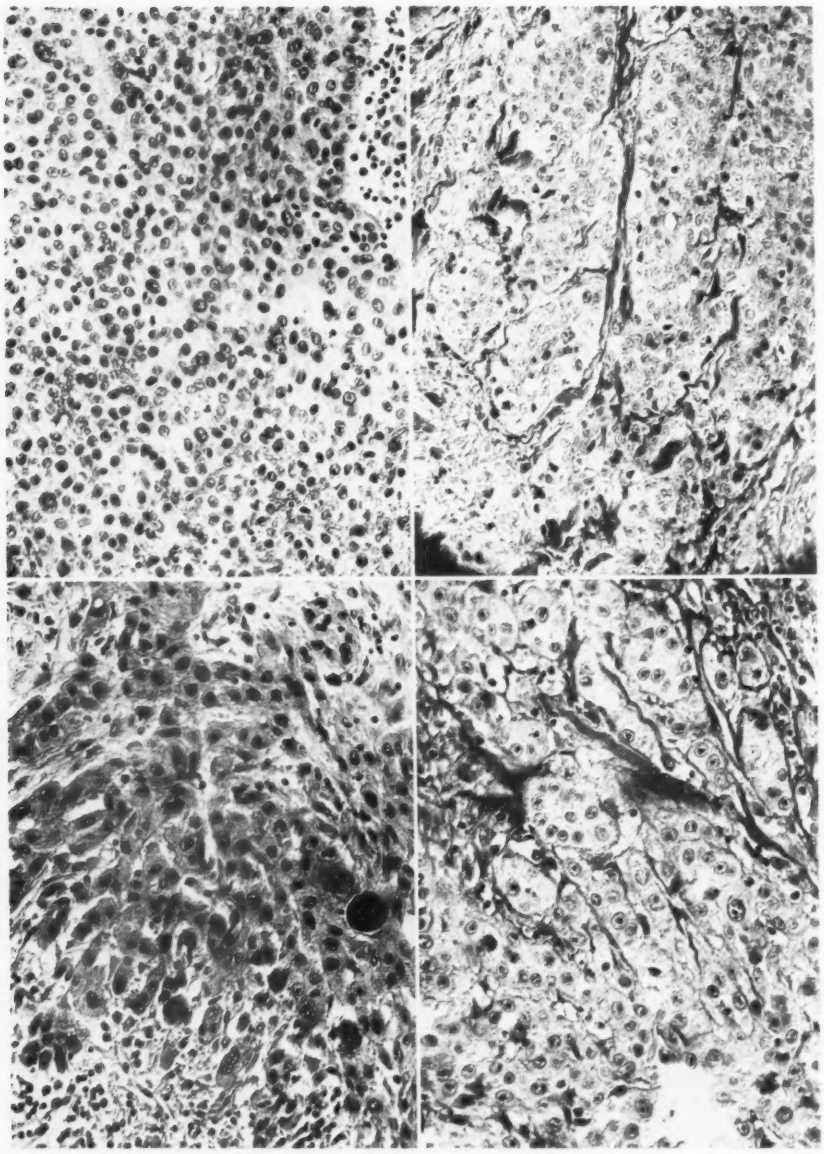

FIG. 2. Case 1. Original lip biopsy showing undifferentiated carcinomatous growth pattern, with formation of a few glands and secretory vacuoles. Hematoxylin and eosin stain.

FIG. 3. Case 1. Recurrent carcinoma invading mandible with growth pattern suggestive of ductal origin. No PAS-positive secretion is present. Pearse periodic acid-Schiff method.

FIG. 4. Another case of cancer of minor salivary gland duct demonstrating undifferentiated "ductal" carcinoma, foci of gland formation, abortive secretion and occasional keratinized cells or keratin foci. Hematoxylin and eosin stain.

FIG. 5. Predominance of ductal growth pattern is illustrated in part of same carcinoma shown in Figure 4. Only the tumor stroma is stained with PAS method. Pearse periodic acid-Schiff method.

sequently the "duct" cases were stained with PAS for mucus.

CLINICAL INFORMATION

All six cases of carcinoma arising in the minor salivary gland ducts of the lower lip occurred in males ranging from fifty-three to eighty-eight years of age. The average age was seventy years. The duration of the disease before treatment was noted as six months in three cases, one year in two cases, and five years in one case.

Three cases occurred in laborers, one of whom was a painter. A tobacco history was elicited in five cases; three men smoked pipes, two smoked cigarettes and one chewed tobacco. One patient had a positive Hinton test for syphilis. Oral hygiene was noted as good in four cases and as poor in two.

The past and family histories were noncontributory.

CASE REPORTS

The following cases are included to illustrate the clinical aspects of this tumor.

CASE I. E. F., a fifty-three year old married white house painter, was first seen with a 2 cm. ulcer of the lower lip of five years' duration. He had smoked a pipe and cigarettes for many years, and there was a history of a 5 pound weight loss during the previous four months. Physical examination was negative except for the lip lesion, carious teeth and poor dental hygiene. No cervical lymph nodes were palpable. Blood studies, including a serologic examination, and urinalysis were negative. A chest x-ray was reported as normal.

He was hospitalized for resection of the right lower lip with reconstruction using an Estlander flap. The original pathologic report was as follows: diffuse growth of neoplastic cells resembling somewhat squamous epithelium, with invasion of muscle but not mucous glands. Cells were large with bizarre nuclei and atypical mitoses; no cornification present. (Fig. 2.) The diagnosis was epidermoid carcinoma, grade 3.

The patient was lost to follow-up for nine months, at which time he returned with a mass fixed to the right horizontal ramus of the mandible, midway between the angle and mental foramen. A right submaxillary lymph node was palpable, but this was thought to be inflammatory rather than neoplastic. X-rays revealed a normal appearance of the chest and bone destruction of the horizontal ramus. Resection of the mass with the attached horizontal ramus and radical neck dissection were performed. Microscopically the recurrence was originally classified as epidermoid carcinoma, grade 2, with negative salivary glands and lymph nodes. Carcinoma was found to invade the mandible. (Fig. 3.)

Within four months a second recurrence was noted involving the descending portion and angle of the remainder of the right mandible. The patient was readmitted for disarticulation of the remaining mandible, and subsequently the internal carotid artery was resected. In spite of preoperative carotid compression, a hemiparesis developed. He died four months later. Postmortem examination disclosed metastatic involvement of both lungs and a local recurrence in the operative site.

CASE II. The patient (PH 28499), an eighty-eight year old white male laborer, was seen because of a "cold sore" of the lower lip of eight months' duration. He had smoked a pipe constantly for forty years. The mouth was edentulous and clean. He presented a 5 cm. superficial ulcerated defect of the lower lip, involving the exposed mucous membrane and adjacent skin of the chin. Firm submental and submaxillary lymph nodes, 0.8 cm. in size, were palpable. The Hinton test was positive for syphilis. Past and family histories were negative. Following biopsy, 6,000 r of radiation was administered. Four months later local disease was not evident, but a 5 cm., tender, fluctuant mass had developed in the left submaxillary region with adjacent induration. Radon needles were inserted with little success, and marked local necrosis and inflammation followed. The internal jugular chain of nodes became involved clinically, and the patient died of cachexia after a total disease duration of fifteen months. Autopsy was not performed.

THERAPY

Unless contraindicated, all patients were initially treated by "U" or "V" excisions, and radical neck dissection was performed if adjacent lymph nodes were clinically suggestive of metastatic cancer. Two patients were considered unsatisfactory for surgical treatment and were treated by radiation, receiving approximately 6,000 r in air (3,000 to 7,000 r). The immediate response was poor in the patients treated by radiation.

The over-all prognosis was unfavorable; of six patients, two lived less than two years, two lived two years, one survived for two and a half years, and the final patient died four years after the initial treatment.

COMPARISON WITH EPIDERMOID CARCINOMA OF LIP

In Tables I and II the more common type of cancer of the lower lip is compared with the

TABLE I

COMPARISON OF MINOR SALIVARY DUCT CARCINOMAS WITH EPIDERMOID CARCINOMAS OF THE LOWER LIP

Diameter (cm.)	Epidermoid Carcinoma (No. of cases)			Duct Carcinoma (No. of cases)
	Grade 1	Grade 2	Grade 3	
0–1.5	52	23	0	0
1.5–3	16	26	1	5
3.1–4.5	3	9	1	0
4.5 and larger	1	2	0	1

TABLE II

PRECANCEROUS LESIONS FOUND IN CASES OF CANCER OF LOWER LIP

	Epidermoid Carcinoma			Duct Carcinoma
	Grade 1	Grade 2	Grade 3	
No. of cases....	72	60	2	6
Leukoplakia....	30	7	0	0
Senile keratosis.	12	1	0	0

"ductal" series. Of the 140 cases of epidermoid carcinoma reviewed, 136 were in men, three in women, and one case was reclassified as a benign keratoacanthoma. This occurred in a woman. Most epidermoid carcinomas occurred in men aged sixty to eighty years; the over-all age range was thirty-two to ninety-four years. Precancerous hyperplastic or other changes of the surface epithelium were not found accompanying the duct carcinomas. (Table II.) In 100 epidermoid and five "duct" carcinomas studied for lymphatic invasion, involvement was found in four and three cases, respectively, reflecting the relatively greater invasiveness and potentiality for metastatic spread of duct carcinomas. The only instance of blood vessel invasion was seen in a case of the "ductal" series.

Enlarged lymph nodes were observed in nine of seventy-two cases of epidermoid carcinoma, grade 1, thirty-eight of sixty with grade 2 and both of the two patients having grade 3 tumors. Palpable lymph nodes were found in three of the six duct carcinomas. Five-year survivals in the epidermoid carcinoma series were as follows: seventy of seventy-two grade 1 (97 per cent), thirty-six of sixty grade 2 (60 per cent) and none with grade 3 (0 per cent). Five-year survivals reported in grade 3 epidermoid carcinomas of the lip among a total of 563 cases at the Pondville Hospital were 65 per cent among twenty-one cases [1]. No five-year survival of duct cancer was observed.

COMMENTS

Although in the past the six cases of cancer reported herein would have been considered as atypical epidermoid carcinomas, we believe them to be sufficiently unusual, pathologically, to warrant distinction from the more common type of cancer of the lip. These cancers are believed to originate from the excretory ducts of the minor salivary glands present in the mucous membrane of the lower lip and, in fact, throughout the entire oral mucosa. This concept of carcinoma arising in the excretory ducts of minor salivary glands is not new. Krompecher [3], in 1922, suggested that some tumors of mucous and major salivary glands are of duct origin. Stewart et al. [4] have presented an extensive historical review of excretory duct cancers of the major salivary glands, and have succeeded in isolating a new specific type of ductal neoplasm, the mucoepidermoid tumor. It is a matter of interest that the most malignant mucoepidermoid tumors behave clinically like the present group of minor salivary gland duct cancers and bear the same fatal prognosis.

Ewing [2] stated that since 1888 it had been recognized that certain buccal carcinomas do not have the familiar squamous epitheliomatous histologic structure. Such names as "mucous membrane type of epidermoid carcinoma," "transitional cell carcinomas" and "embryonal epithelioma" have been attached to the oral epithelial cancers that grow without outstanding keratinization and whose cells palisade and form abortive duct or glandlike structures. It now appears generally accepted that the ducts of the small accessory buccal mucous glands are the source of many of these carcinomas.

The importance of recognizing this uncommon type of cancer lies in the necessity for energetic treatment if its otherwise inevitably fatal prognosis is to be thwarted.

Admittedly no generally valid conclusions can be drawn from a study of six cases. It ap-

pears, however, that there has been no clinical differentiation between this type of cancer and the ordinary type of cancer of the lip. It would also appear that primary surgical therapy should be more extensive than the routine use of a "U" or "V" excision. There is reason to doubt the efficacy of radiation treatment of these cancers.

SUMMARY

Six males with duct carcinoma of the minor salivary glands of the lower lip are reported, comprising about 4 per cent of 140 cases of cancer of the lip reviewed. Clinically these carcinomas resemble ordinary cancers of the lip except for their worse prognosis. Pathologically they are characterized by (1) involvement of the mucous membrane surface of the lip without transitional changes of the adjacent overlying epithelium; (2) deep invasion and frequent lymphatic spread; (3) histologically a sheetlike growth pattern of undifferentiated malignant epithelium with occasional tubule and duct formations; (4) evidences of abortive secretion; (5) a few keratinized cells and keratin foci without demonstration of any mucus production; and (6) an increased likelihood of regional and distant metastasis.

Radiation therapy is apparently ineffective and surgical treatment should extend beyond the routine "U" or "V" excision if cures are to be obtained.

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The Perils and Pitfalls of the Vasectomist

MILEY B. WESSON, M.D., *San Francisco, California*

THE vasectomist is particularly vulnerable because each operation exposes him to a suit for either (1) malpractice, (2) breach of contract or (3) assault. It is reported that in San Francisco there are 100 malpractice suits filed a month and that 85 per cent of all Superior Court cases are damage suits of some type.

Vasectomies are performed by private surgeons primarily for two reasons: (1) sterilization or (2) the prevention of epididymitis following prostatectomy. (Many states have laws that provide for the sterilization of the insane, chronic criminals and sexual perverts.)

Local hospitals no longer permit their facilities to be used for the sterilization of roues; or limiting the size of a family, irrespective of what reasons are given, be they economic, the fact that the patient already has too large a family or that another pregnancy might endanger the woman's life. Since the law specifically states that sterilization can be done only to *preserve life*, a consultation slip, with detailed reasons, should be signed by several reputable consultants, just as in the case of a therapeutic abortion.

When a pregnancy follows bilateral vasectomy, a plaintiff's attorney frequently sues for "breach of contract." Theoretically, the seminal vesicles are empty of sperm within a few months, but cases have been reported of their persistence for a year. Also, it is not unusual for the cut ends of the vasa to join up by means of a channel through the intervening scar tissue. The majority of such claims are not featured in print because they usually are settled out of court for sizable sums, the doctor not wanting the notoriety of having performed a vasectomy, particularly if he is on the staff of a Catholic hospital.

Last year a very wealthy man in New York City refused to pay a urologist for performing a Steinach operation (vasectomy) on the grounds that such surgery was illegal, and he dared the doctor to sue to collect his fee.

Recently a urologist who made a cystoscopic examination to determine the cause of hematuria in a plaintiff, at the request of the insurance carrier's attorney, was subpoenaed by the plaintiff's lawyer to appear before the district attorney and explain why a warrant for "assault and battery" should not be issued. One who has performed vasectomy can expect no mercy from attorneys of that type.

A subject that concerns practically all urologic surgeons is, does a permit slip signed by both husband and wife for bilateral vasectomy at the time of prostatectomy or transurethral resection protect the urologist and hospital from suit? The answer is no. Many such suits have already been tried but the court findings have not been conclusive.

The legal department of the American Medical Association says it believes that a signed permit is sufficient. However, the attorneys of the California Medical Association state that the law, under the present statutes and decisions, regards the operation for sterilization as mayhem unless for the *preservation of life*, since our laws are based on the old English common law. In the early days sterilization and castration were synonymous, and Blackstone specifically states that sterilization and mayhem were felonies. That opinion is still binding until a court of sufficient standing gives a different interpretation. As soon as a doctor and hospital are brought to trial in a Superior Court, and there is a Supreme Court ruling on the jury's verdict, the English common law will no longer be binding. However, who wants to volunteer as a legal guinea pig and be a litigant for about seven years?

Perils and Pitfalls of the Vasectomist

Vasectomy is an empirical operation performed at the time of prostatectomy presumably to prevent epididymitis. It is based on the assumption that infection from the prostate and seminal vesicles passes downward through the vas to the epididymis. There are no reports of any experimental findings in the literature to support such an assumption; those having made experimental studies enunciated that merely as a theory. Clinicians who have not read the original articles have accepted the theory as a proved fact. No one has ever reported finding organisms in the lumen of a vas. In view of the fact that all tissue removed in an operating room passes through the hands of the hospital pathologist, if organisms were commonly present in the vas there should be some authentic reports in the literature. Positive findings would be very helpful for the defense of the test case that will undoubtedly appear on some court docket in the near future. Since age does not necessarily make a man sterile, incontrovertible facts and not questionable theories will be invaluable to the defense, if and when such a suit is filed.

We know that spermatozoa pass upward from the epididymis to the seminal vesicles by means of peristaltic waves, comparable to those of the intestines that pass from above downward. If infection passed through the vas from the prostate to the epididymis, it would be due to reverse peristalsis. It is possible for such to occur and undoubtedly it does, just as under certain conditions such occurs in the intestinal tract. There are several cases reported in the literature of patients with a hypertrophied prostate obstructing the external sphincter, in whom, following long-continued straining to void, a dilated posterior urethra developed. Following the loss of tone of the sphincter of the ejaculatory ducts, the structures became patulous and eventually the toneless vas was dilated, so that the infected urine entered it freely but did not enter the epididymis.

We know that infections elsewhere in the body extend from a focus through the lymph and blood vessels. There is no reason to assume that nature has made a special exception in the case of the prostate. Hence, it is the generally accepted view that the infection passes downward from the prostate and seminal vesicles through the lymphatics and blood supply to the epididymis, not through the lumen of the vas.

A pain in the groin is the earliest symptom to appear in cases of acute epididymitis. This is caused by the tight external inguinal ring pinching the swollen spermatic cord that often becomes 2 cm. in diameter. Hence, the proper designation of the condition is funiculitis, not vasitis.

There have been published many series of statistics as evidence that vasectomy decreases the incidence of epididymitis following prostatectomy. They are just as inexact and valueless as the numerous series of rejuvenation statistics published several decades ago. The journals at that time were replete with reports by Dr. Steinach's disciples. They concentrated on the rejuvenating effects, such as increased longevity, restoration of sexual vigor, disappearance of beginning senility, the return of graying hair to its original color, etc. The prevention of epididymitis was never mentioned. Similarly none of the current vasectomy statistics mention rejuvenation or make any claims of increasing the longevity of the subjects or restoring sexual vigor.

The compilers of the modern series have made no distinction as to the type of operation used, whether the vas alone (free of all lymph and blood vessels—a true Steinach operation) or whether all or part of the spermatic cord (exclusive of the spermatic artery) was included in the ligature. Furthermore, the proponents of vasectomy at the time of prostatectomy do not allege that the operation always prevents epididymitis, but merely that it decreases the incidence.

If the surgeon believes that the epididymitis, which sometimes plagues the prostatectomist, is due to the presence of an indwelling catheter and can be prevented by vasectomy, then it is not logical to postpone the ligation of the vasa until the time of prostatectomy. They should be tied off when the catheter is inserted for drainage.

In 1934 at Cleveland, during the American Medical Association Convention, I discussed the subject with the late Herman Kretschmer and told him that I had ceased performing routine vasectomy as I did not believe it was a scientific procedure; he told me that he felt the same way. Later he put his views on record, stating that with rapid technic and careful manipulation, avoiding unnecessary

roughness, his incidence of epididymitis had become so low that he regarded vasectomy an unnecessary procedure and rarely ever performed the operation.

It has been said by a seasoned judge that if you want to find justice look in the dictionary, not in the courts. Another legal savant has well said, "Sterilization is controversial, and controversy is frequently conducted on the plane of emotion rather than of logic. Even some of the judicial decisions bear marked resemblances to forensic exercises or anthologies of verse."

On careful review of the literature no report could be found of positive evidence of the passage of infection down the vas. This study has been supplemented with many hours in the San Francisco Law Library examining the reports of the cases passed on by English and American courts. We know that the plaintiffs' attorneys have an association of over 5,000 members (the National Association of Compensation Claimants' Attorneys), most of whom specialize in obtaining the "adequate verdict" in malpractice cases, damage suits of various types, and divorces. Thus the conclusion is easily reached that one who performs a sterilization procedure of any type without legal authority, except directly to "preserve life," is inviting trouble.

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NEW INSTRUMENTS

A Forceps Used in the Repairs of Tendons and Nerves

ROBERT D. LARSEN, M.D., *Detroit, Michigan*

From the Department of Surgery, Wayne State University College of Medicine, the Surgical Service of the City of Detroit Receiving Hospital, and the University Service of The Grace Hospital, Detroit, Michigan.

TENDONS and peripheral nerves occupy a high position on the list of those structures in the body which demand exceedingly careful and gentle handling during surgery if good results are to be obtained. Because of our dissatisfaction with the instruments which are commercially available and which we believe are usually employed during the repair of tendons about the hand and during the repair of larger peripheral nerves in the extremities, an attempt has been made to devise a forceps which will reduce the trauma incident to the operative handling of these tissues. The small mouse-tooth type of tissue forceps has seemed to us to cause unnecessary trauma when used during the repair of tendons and the larger peripheral nerves.

The illustrations of tendon and peripheral nerve repair, which are found in most textbooks, depict the tendon and nerve ends as exactly and squarely cut across. The finished suture line is depicted as a single straight line. Indeed, the illustrations of the repaired structures appear as if they were two pieces of board butted together. Anyone who has had a volume of experience with this type of surgery is cognizant of the difficulties which are encountered when one attempts to perform a repair of this kind. Frequently when the tendon or nerve is being débrided, a certain amount of fraying of the ends of the tendon or nerve is produced. If this fraying of the ends occurs, it prohibits an exact end-to-end suture of the divided structures. During the actual suture of the divided structures one is often harrassed by the difficulty encountered when one attempts to cause the needle carrying the suture to come out of the tendon or nerve at exactly the desired point. This is particularly true when it is necessary to pass the needle through the cut end of the tendon and bring it out through the side of the tendon. When one is suturing the larger peripheral nerves, handling of the cut edge of the nerve, and in particular the cut edge of the nerve sheath, with a mouse-tooth forceps is almost inevitable. This extra handling of the cut edge of the

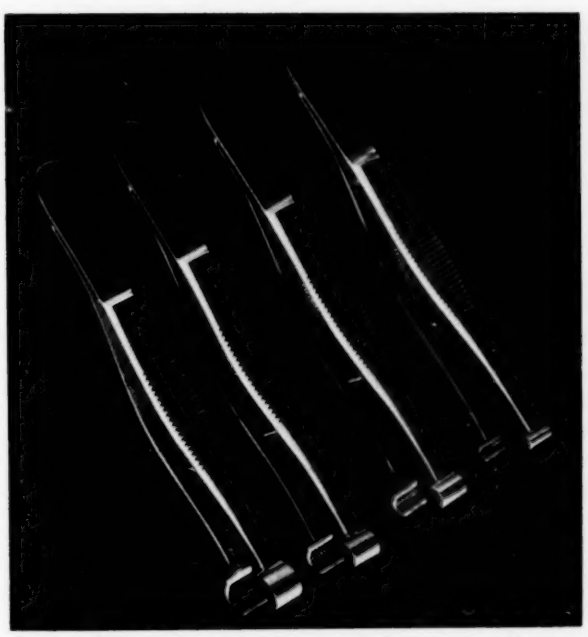

FIG. 1. The four sizes of the forceps described in the text.

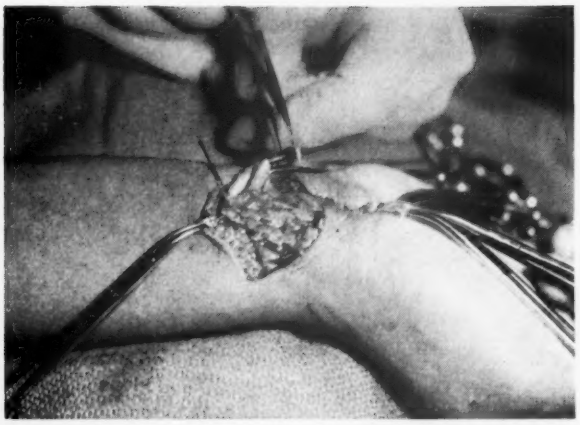

FIG. 2. Débridement of a tendon preparatory to repair of a tendon. Only the portion of the tendon to be removed protrudes through the forceps. The razor blade is passed along the edge of the instrument.

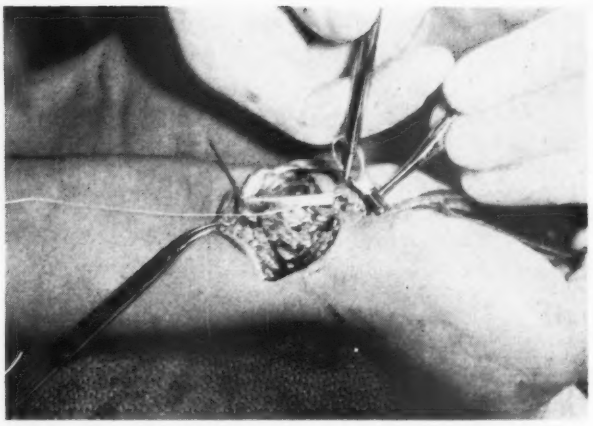

FIG. 3. Suture of a tendon in the wrist. The portion of the tendon to be included in the suture protrudes through the forceps. The needle passes through the tendon and emerges from the tendon exactly at the edge of the forceps. Using this technic, it is unnecessary to touch the cut end of the tendon. There is no buckling of the tendon while it is being sutured.

structure being repaired must surely lead to trauma.

Because of the technical difficulties enumerated in the preceding paragraph, we sought to devise a forceps which would enable one to suture these divided structures with a minimum of surgical trauma. Because the tendons and nerves are cylindrical objects, it seemed that a forceps of cylindrical shape would be the most suitable. Consequently, a group of forceps (Fig. 1) were designed which have the following characteristics:* Originally the width of the forceps blade was 1 cm. Because of the width of the blade the forceps could not be employed in handling the distal end of a tendon which had been divided within 1½ cm. of its insertion. This was true simply because there was insufficient tendon attached to the insertion to allow grasping of the tendon with a 1 cm. wide instrument and still allow adequate room for débridement and suture. The blades of the instruments have now been reduced to 0.6 cm. This width has been much more satisfactory. Each blade is a complete semi-circle. Four such forceps were made. When the forceps is completely closed, a complete circle is formed. The diameters of the circles formed when the forceps are closed are 0.2, 0.4, 0.6 and 0.8 cm. To date we have not found a tendon large enough to require the largest size forceps.

The insides of the jaws of the forceps were originally completely smooth. Slipping of the tendon or nerve in the jaws of the forceps was noted. The jaws were lightly scored with a fine tap. This modification eliminated the slipping of the structure which was being repaired. As illustrated in Figure 1, the edges of the jaws are serrated with fine teeth. The forceps was designed with serrated edges in the hope that the flat, broad surface would be relatively atraumatic® in the handling of large skin flaps, particularly within the hand. This has not been found to be true and the serrated edges could be conveniently omitted. The forceps are made of stainless steel. They were constructed from the original drawings, since no similar instrument was available for use as a model.

* Forceps made by the Randolph Surgical Company of Detroit, Mich.

OPERATIVE TECHNIC EMPLOYING THESE FORCEPS

One of the most valuable contributions to the surgical handling of tendons and larger nerves made by these forceps occurs in the débridement of these structures preparatory to their suture. The structure to be débrided is grasped with the forceps so that only that portion to be removed protrudes from the end of the forceps. Using a sterile razor blade, which is the sharpest instrument commonly available in the operating room, the portion to be removed is excised by passing the razor blade exactly along the edge of the forceps. (Fig. 2.) The resulting cut end is completely free of fraying, presents an exactly plane surface, and the plane of the cut surface is exactly at right angles to the long axis of the divided structure. No other means of producing so

exact an end on a divided tendon or nerve has been encountered in our experience. It is our belief that if these forceps contribute nothing else to the surgery of tendons and larger nerves, the great improvement in the ability to produce an exactly cut end would justify their use.

During the actual suture of the divided structures, the tendon or nerve is grasped with the forceps so that only that portion which is to be incorporated within the suture protrudes from the end of the forceps. (Fig. 3.) The needle is then passed immediately adjacent to the edge of the forceps. Using this technic, sufficient rigidity is imparted to the tendon or nerve so that no buckling of the structure occurs while it is being sutured. This amounts to placing the sutured tissue under tension, which assists in the suture of all structures, but avoids the necessity of grasping the cut end of the tendon or nerve with a mouse-tooth forceps. Using the forceps in the manner outlined heretofore, it is our impression that a higher degree of accuracy in the suture of tendons and larger nerves is possible than was possible with any of the other commonly employed technics.

The forceps which have been constructed so far are adaptable for the suture of lacerated tendons of many sizes, ranging from the tendons of the very young to the heavy, thick tendons of the laborer. They are also adaptable to the repair of the larger peripheral nerves, but the diameter of the circle enclosed by the jaws of the forceps is too large for the handling of the common and proper digital nerves encountered in the palm and fingers. This defect could be remedied by making a more delicate instrument with a smaller diameter between the jaws.

SUMMARY AND CONCLUSIONS

A forceps has been designed which in our experience has reduced the operative trauma incident to the repair of lacerated tendons and the larger peripheral nerves. The repairs achieved when these forceps are employed appear to us to be more accurate than any which have been possible with the conventional operative methods. The characteristics of the original model are described. Certain modifications which were found necessary are also described.

A Simple Manual Dermatome

JOHN T. BATE, M.D., *Louisville, Kentucky*

Read at the joint meeting of The Kentucky Surgical Society and The Virginia Surgical Society, White Sulphur Springs, West Virginia, in Apr., 1958.

SINCE not infrequently the surgeon must provide skin coverage for a small denuded area on the hand or some other part of the body, it would be desirable to have an inexpensive, simple instrument available which will cut an even, split-thickness graft of approximately 0.016 inch, using a readily available safety razor blade and not requiring rubber cement, electrical connections, tapes, etc.

By adapting the mechanical principle of the hand-operated hair clipper, such an instrument was devised: Two posts were placed in the plate so as to engage the slot present in the Durham Duplex Safety Razor blade, in order to allow the blade to move from side to side in a fixed plane. A driving plate with a pin fitting into the 1/16 inch hole already present in the safety razor blade was fitted so that the movable handle propels the driving plate and the blade from side to side. To these were added a holding plate, compression spring and wing nut on the stud to hold the parts together. To determine the thickness of the graft, a finely serrated roller was placed before the blade. Guards were placed at each side to prevent the lateral edges of the blade cutting irregularly without severing the graft from the skin as the instrument advances. (Figs. 1, 2 and 3.)

The instrument will cut a graft 1 5/8 inch wide and approximately 0.016 inch thick. To some extent the thickness is determined by the pressure which the operator exerts. It is probably 0.020 inch at times.

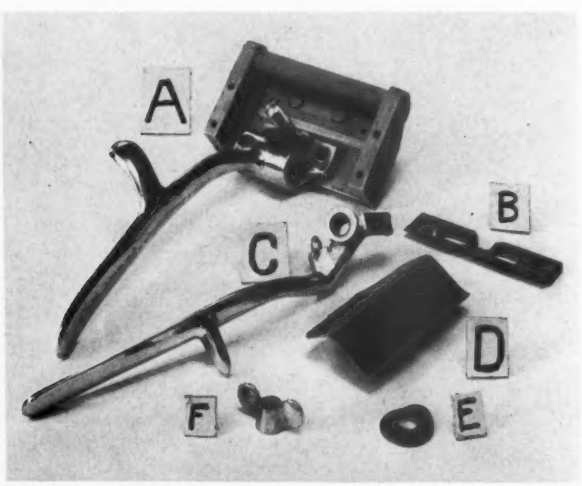

FIG. 1. A, stationary handle, base plate and roller with Durham Duplex Safety Razor blade in place; B, driving plate with pin which engages the blade; C, movable handle; D, compression plate; E, compression spring; F, wing nut.

TECHNIC

The following procedure has been devised: After moistening the skin with saline or coating with mineral oil, the skin is held taut and the instrument placed on the skin so that the roller, blade and front part of the base plate are in the same plane. Holding the fixed

FIG. 2. Blade and driving plate in place.

handle with the thumb and the movable handle with the fingers of the right hand, the thumb and index finger of the left hand are used to steady the instrument and pull it slowly forward. At times the index, middle and ring fingers of the left hand have been placed on the roller so as to start the forward motion and prevent side-to-side movement. The thumb of the right hand against the fixed handle steadies the instrument and provides a fixed point for the fingers to work against. The blade is driven by slowly squeezing the index, middle and ring fingers against the movable handle. The tendency is to move the fingers rapidly; however, this is not necessary. The slow rhythmical movement is more effective and does not throw the instrument off its course.

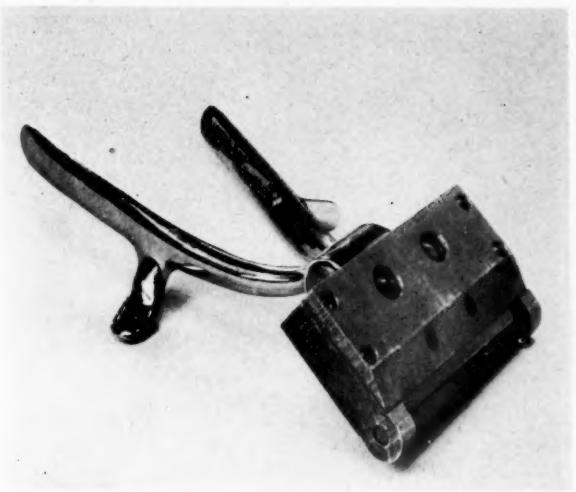

FIG. 3. First model of instrument without guards for ends of blades.

Acknowledgment: The experimental instrument has been made in collaboration with Mr. Marshall Morrison, Director of Research, The Orthopedic Frame Co., Kalamazoo, Michigan.

CASE REPORTS

Ulcerogenic Tumors of the Pancreas

JAMES W. HENDRICK, M.D., JOE S. DAVIS, M.D. AND JOHN L. SHAMBLIN, JR., M.D.,
Tuscaloosa, Alabama

From the Departments of Surgery and Pathology, Druid City Hospital, Tuscaloosa, Alabama

THE recognition by Zollinger and Ellison [5] that non-insulin–producing islet cell adenomas of the pancreas exist, has clarified to a degree an etiological factor present in the severe ulcer diathesis occasionally observed in a patient. These authors have gathered data on some forty-eight cases of this type of tumor associated with marked ulceration of the duodenum, jejunum and marginal ulcerations. There have been previous reports that the pancreas was suspected of being an etiological factor in severe gastroduodenal and jejunal ulcerations [1,3,4]. At the present time, the exact mechanism of severe ulcer diathesis and which one (or which combination) of the non-insulin–producing islet cells is involved, has not been established; in all probability, the alpha cell is predominately associated with the diathesis as it produces glucagon which is an antagonist to insulin, and an overproduction of this substance could account for an excessive gastric hypersecretion resulting in gastric, duodenal, jejunal and marginal ulcerations. All non-insulin–producing islet cells, i.e., alpha, delta and gamma, should be considered; the insulin-producting beta cell is automatically eliminated. Biological assays of these tumors, when removed, will probably ultimately disclose which cell or cells are the offenders.

Zollinger and McPherson [6] state that, theoretically, one or more of the islet cells, in ordinary numbers, may play a role in the normal production of gastric juice; hence, when one or more occur in an adenoma, or when marked hyperplasia of the cells occurs, there is extensive secretion of hydrochloric acid and the development of a severe ulcer diathesis.

A triad of diagnostic symptoms and findings enumerated by Zollinger and Ellison [5] is as follows: First, a fulminating ulcer diathesis is present which involves the duodenum or jejunum or gastrojejunal ulceration secondary to radical surgical intervention and which persists following intensive medical management and/or radical surgery. Second, marked gastric hyperacidity is demonstrated by a twelve-hour nocturnal gastric aspiration. Not infrequently, as many as 2 or 3 L. of gastric juice will be aspirated by constant gastric aspiration and the total amount of free hydrochloric acid may exceed 250 to 300 mEq., in contrast to a normal twelve-hour value of 18 mEq. The tendency to produce large volumes of gastric juice persists as long as any gastric-secreting mucosa is retained. Third, when a non-beta islet cell tumor of the pancreas is found, the triad is complete.

The twelve-hour nocturnal gastric secretion in patients with non-insulin–producing islet cell adenomas of the pancreas may reach a phenomenal level even after vagotomy and radical gastric resection. From the observations of Dragstedt [1], Elman and Hartman [3], Poth et al. [4] and Zollinger and Ellison [5], apparently there is some intrinsic factor in the pancreas not related to its external secretions which, in all probability, influences ulcer formation. Biological assays of these tumors by Zollinger and Ellison [5] suggest that the material in question probably acts

as a chemical or hormonal stimulation to the gastric glands when the cephalic and antral phase of gastric secretion has been eliminated by vagotomy, subtotal gastrectomy or both.

In patients with unusual and severe types of peptic ulcerations of the stomach, duodenum or jejunum, in whom gastrojejunal ulceration develops following partial gastrectomy, or in patients who do not respond to adequate medical management or who have had complete vagotomy, non-insulin–producing islet cell tumor of the pancreas with ulcerogenic potential must be considered. Surgeons who are confronted with the problem of controlling recurrent marginal ulcers or atypical primary ulcerations should not overlook the possibility of the presence of an ulcerogenic tumor of the pancreas. If a tumor is not found, it is thought justifiable by Zollinger and Ellison [*2,6*] to resect the body and tail of the pancreas before subjecting the patient to total gastrectomy in an attempt to control the acid factor, as there may be either small and diffuse involvement of the islet by the tumor, or hyperplasia.

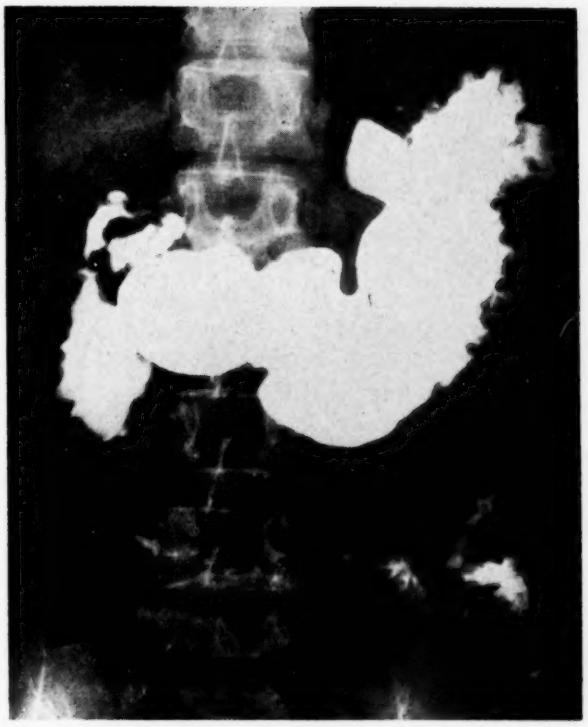

FIG. 1. Case 1. Roentgenological examination of the stomach demonstrating a large duodenal ulcer with crater or niche, also a moderate size gastric ulcer on the lesser curvature of the stomach.

CASE REPORTS

CASE 1. J. A. C. (service of J. W. H.), a white man, twenty-eight years of age, was observed in January 1955 with a history of gnawing pain and fullness in the epigastric area of seven months' duration. Three weeks before observation, the patient had had a severe gastric hemorrhage which required five units of blood to restore the blood volume. A diagnosis of duodenal ulcer and gastritis had been established in October 1954, and the patient had been placed on strict medical management consisting of a bland diet, antispasmodic and vagal blocking drugs. The patient had felt somewhat better for a period of two months after which time his symptoms had returned. He had continued to follow a strict medical program until the date of admission. Ten days prior to that time, almost constant vomiting developed with pain penetrating from the epigastric area into the region of the twelfth thoracic vertebra.

Physical examination at the time of admission showed a well developed, poorly nourished white man who was extremely anxious about himself. All systems were essentially normal except for marked tenderness in the right epigastric area, a red blood count of 2.0 million per cm. mm. with hemoglobin 8 gm. per cent and packed cell volume 22 per cent. Urinalysis and other blood studies were normal; fasting blood sugar determination was 105 mg. per cent.

Roentgenographic studies of the gallbladder and gastrointestinal tract disclosed a duodenal and gastric ulcer. (Fig. 1.) The twelve-hour nocturnal gastric secretion determination was 3,060 cc. with 98 clinical units of free hydrochloric acid and total acidity of 109 with 294 mEq. of hydrochloric acid. The patient had been taking small doses of Demerol® several times daily for the previous two weeks to relieve pain.

Due to the lack of results from a strict medical program and because of severe pain and gastric hemorrhage after the patient's blood volume was restored, partial gastrectomy was deemed advisable; this was performed in February 1955. At operation, a posterior duodenal ulcer, 3 cm. in diameter, was present in the first portion of the duodenum. A second ulcer, measuring 2 cm. in diameter, was present on the lesser curvature of the stomach. (Fig. 2.) Seventy per cent of the stomach was resected, including the right gastric artery.

The patient's convalescence was excellent; he returned to his occupation as a deputy sheriff and remained symptom free for a period of eight weeks after which pain and burning in the left epigastric area developed with symptoms of a gastrojejunal ulcer which was demonstrated by roentgenographic studies of the upper gastrointestinal tract. (Fig. 3.) A twelve-hour nocturnal

FIG. 2. Case 1. Specimen of resected stomach after partial gastrectomy. Two duodenal and two gastric ulcers are present.

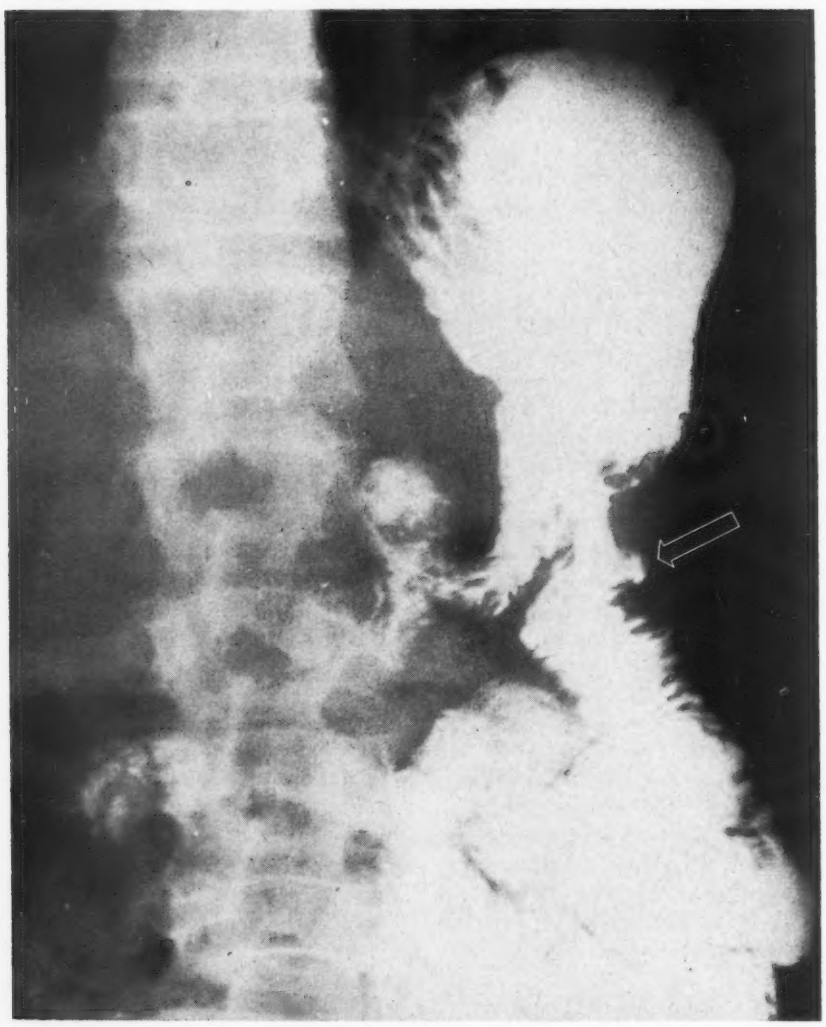

FIG. 3. Case 1. Roentgenological examination of the stomach demonstrating a marginal ulcer which occurred 2 cm. from the anastomosis three months following extensive partial gastrectomy. This ulcer was not altered by thoracic vagotomy or strict medical management.

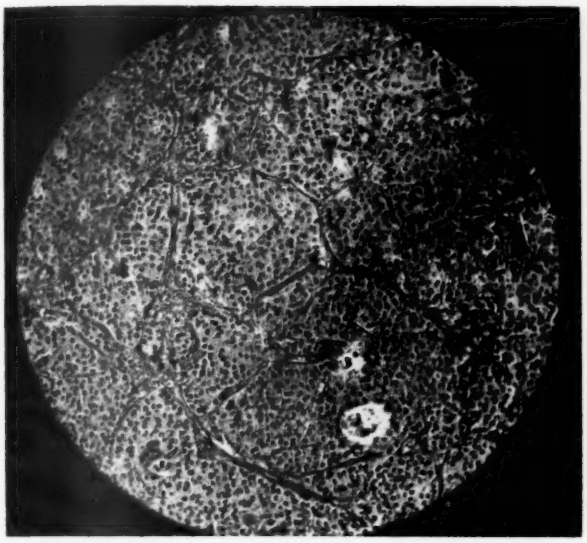

FIG. 4. Case 1. Low power photomicrograph of non-insulin–producing islet cell tumor of the pancreas.

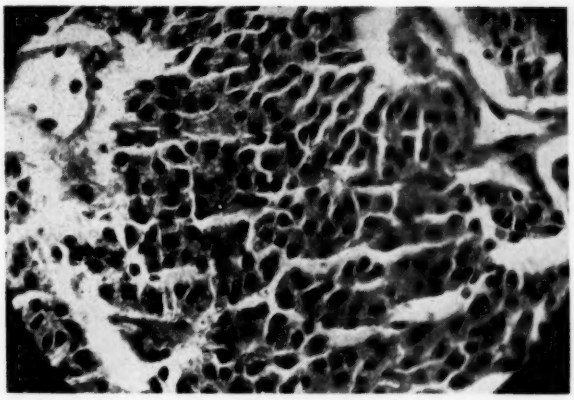

FIG. 5. Case 1. High power photomicrograph of non-insulin–producing islet cell tumor of the pancreas.

gastric secretion determination was 2,850 cc. with 110 clinical units of free hydrochloric acid and 118 clinical units of total acidity. The patient was given a strict medical program consisting of vagal blocking drugs, antispasmodic medication and bland diet. The symptoms were relieved temporarily but recurred and increased in intensity after a period of four weeks.

Transthoracic vagotomy was performed in June 1955, followed by relief of symptoms for a period of eight weeks, after which the symptoms recurred and a severe gnawing sensation developed in the epigastric area. The patient had remained on medical management. A third twelve-hour nocturnal gastric secretion determination demonstrated 2,800 cc. of gastric secretion with 204 mEq. of hydrochloric acid. The patient remained on medical management and continued at his occupation; symptoms of ulcer persisted until December 1955, when he had two gastric hemorrhages in a period of two weeks. Roentgenographic studies of the upper gastrointestinal tract disclosed two different gastrojejunal ulcers. The patient was advised that he should have more extensive surgery with probable resection of the entire stomach.

During this period the report of Zollinger and Ellison [5] was reviewed in the surgical literature, after which the possibility of this patient having an ulcerogenic tumor of the pancreas was considered. He was prepared for gastric resection and at operation extensive ulceration of the gastrojejunal margin was found. When the pancreas was examined a nodular enlargement involving its distal end was found. The distal third was resected and the remainder carefully examined and found to be normal; high subtotal gastric resection was performed. There were no enlarged lymph nodes in the drainage area of the tail of the pancreas. The patient had an uneventful convalescence; after a period of two months he had regained his normal weight and returned to his occupation, free of symptoms. One year following removal of the ulcerogenic tumor of the pancreas and second gastric resection, acute appendicitis developed for which the patient was operated upon by his family physician. At this time, the patient states that he is entirely free of symptoms except for some fullness following ingestion of a large meal. His weight is normal.

The specimen removed, which measured 10 by 5 by 3 cm. weighing 110 gm., consisted of the tail and part of the body of the pancreas. A tumor, which measured 5 by 4 by 3 cm., was identified at the junction of the tail and body of the pancreas. It was dissected out and contained a definite fibrous capsule. The pancreas was brownish-yellow in color, firm in consistency and showed the usual lobulations. On section, the tumor showed fine lobulations and was pinkish in color.

Microscopical examination disclosed a well differentiated epithelial neoplasm which consisted of adenoid masses of cells tending to be separated by fairly large septums of connective tissue. Within the pattern of tumor growth, there was some lobulation with the formation of small cellular groups, five to ten cells across. Individual cells had oval nuclei which were moderately deeply stained with multiple deposits of chromatin material. Surrounding the nuclei, the cytoplasm was moderately abundant and had a slightly granular amphophilic staining character. The cytoplasmic cellular boundaries were distinct. In a number of areas the tumor cells could be seen to disrupt pre-existent collagen in a definite infiltrating pattern. (Figs. 4 and 5.) Two sections had the appearance of metastatic tumor in lymphoid tissue with development of the tumor to the point of obliteration of lymph node structure. Masses of tumor cells could be seen in lymphatic

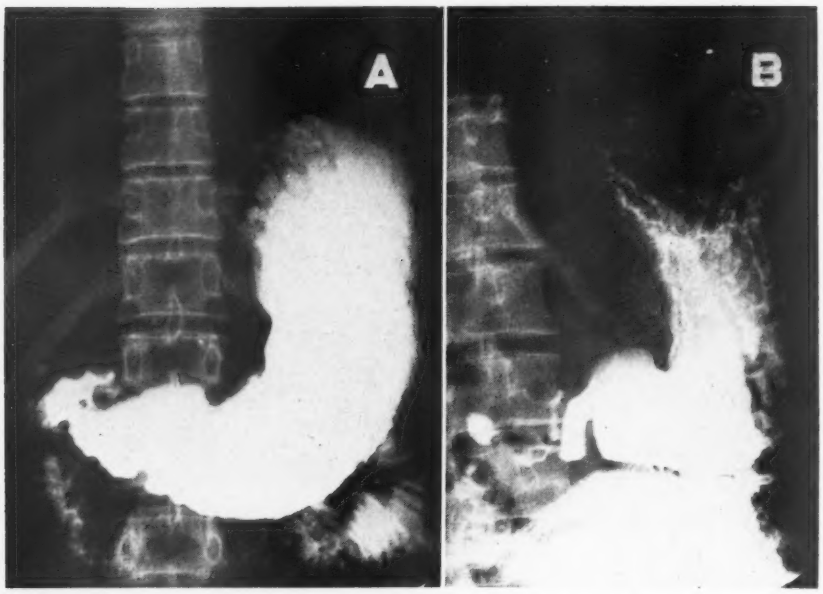

FIG. 6. Case II. A, roentgenographic study of the stomach and duodenum which demonstrates marked deformity of the duodenal bulb consistent with duodenal ulcer. B, roentgenographic study of the stomach, six months later than (A), demonstrating marked changes in the duodenal bulb; a large crater is present.

channels of clearly defined anatomic character in several points in the larger specimens of tumor. No pancreas cells, as such, were identified in the material studied. A diagnosis of islet cell adenocarcinoma was made.

CASE II. Mrs. F. E. H. (service of J. S. D. and J. L. S.), a white, twenty-six year old, married housewife, was admitted to the hospital in September 1956, with a history of gnawing, burning pain in the epigastric area of four months' duration. The patient smoked approximately one package of cigarettes daily. Her bowel function was normal; she stated that she was a "chronic worrier" and had had nervous tension for a period of several months. She had had three normal pregnancies. One week prior to admission nausea, vomiting and severe epigastric pain had developed. A diagnosis of gastritis, or duodenitis, was made at that time, following roentgenological studies of the gallbladder and upper gastrointestinal tract. The patient was placed on medical management consisting of a bland diet, antispasmodic and vagal blocking drugs. Her condition improved temporarily and she was discharged from the hospital on the tenth day; the symptoms of duodenal ulcer continued. On December 3, 1956, the patient was again hospitalized with a history of nausea, vomiting, severe pain in the epigastric area and heartburn. Further roentgenological studies demonstrated a definite duodenal ulcer. Blood and urine studies were normal. The patient continued on medical management, improved slightly and was subsequently discharged from the hospital.

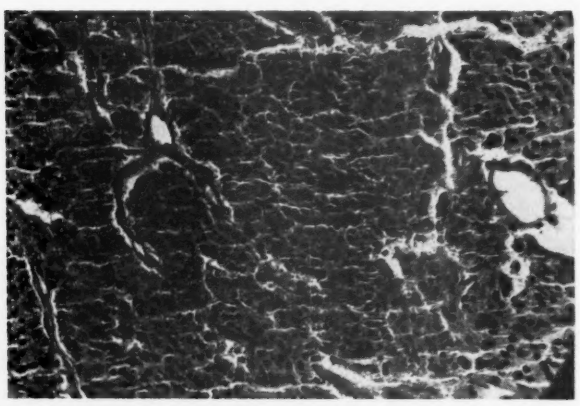

FIG. 7. Case II. Photomicrograph of non-insulin–producing islet cell tumor of the pancreas.

She was next observed in July 1957, with severe epigastric pain, nausea and vomiting of two weeks' duration. She had lost 10 pounds in weight during the previous three months; she had remained on medical management since September 1956. Roentgenological studies of the upper gastrointestinal tract demonstrated an active duodenal ulcer with gastritis. (Fig. 6A.) After a period of two weeks, she was discharged from the hospital with some improvement and was advised to continue medical management. The next hospital admission was in March 1958, at which time the patient was having severe epigastric pain, nausea and vomiting with further weight loss. She had continued to follow a very careful medical program. Blood and urine studies were normal; roentgenological studies of the upper gastro-

intestinal tract demonstrated marked scarring and deformity of the duodenal bulb with retention of 70 per cent of the gastric contents at the end of five hours. (Fig. 6B.)

The patient was prepared for partial gastrectomy. At operation a large posterior penetrating duodenal ulcer was found. During the surgical procedure a tumor was observed partially embedded in the pancreas at the junction of its body and tail. There were four or five enlarged lymph nodes in the mesentery around it. The tumor was dissected out and the enlarged lymph nodes in the mesentery were removed. Immediate frozen section showed the tumor to be of pancreatic origin. The patient made an uneventful recovery from the operative procedure and for the first time in more than two years, was entirely free of symptoms.

The pathological report described the specimen as a nodule weighing 14 gm. and measuring roughly 3½ by 2½ by 2½ cm. The external surface had the appearance of a fibrous membrane which was very thin and contained a number of ecchymoses and thin, slender blood vessels. A cross section of the tumor showed it to be rather uniform and light tan in color.

Microscopical examination demonstrated that the tumor grew as solid nodular masses of uniform cells which showed interconnection and extreme differentiation. The individual lobules of tumor cells were separated by fine septal bands of fibrous connective tissue containing blood vascular structures. The individual tumor cells were comparatively small with round, slightly vesicular nuclei containing scattered clumps of deeply stained chromatin material. (Fig. 7.) The cytoplasm was amphophilic, moderately abundant and granular; the inner cytoplasmic cellular boundaries were distinct. There was no necrosis in any part of the tumor. At the peripheral margin of the tumor a reactive pseudocapsule was present, composed of rather dense collagen which showed active infiltration of the tumor cells, which split and formed fragment pre-existent connective tissue and which conformed to the granular structure of the connective tissue. In this region the lymphatic channels were dilated and in one part, the embolus of tumor cells of clearly defined character could be seen within vascular channels of apparent lymphatic type. At one point, a pre-existent ductal structure of pancreatic type could be seen although no pancreatic islet tissue could be identified. A diagnosis of islet cell adenocarcinoma was made.

COMMENTS AND SUMMARY

The case histories of two patients with ulcer diatheses and non-insulin–producing islet cell tumors are presented. Histological slides of both cases were presented to Drs. Robert Zollinger and J. W. Old of the Ohio State University Hospital, with a clinical history of each case. It was the opinion of these investigators, as well as that of our own pathologists, that these tumors were islet cell adenocarcinomas.

It is recommended that in any patient with a severe ulcer diathesis not amendable to carefully planned medical management in whom marginal ulcer develops following partial gastrectomy and/or vagotomy, the possibility of non-insulin–producing islet cell tumor of the pancreas should be considered. In all probability, more of these tumors would be discovered if they were considered, in younger patients, particularly females, who have severe ulcer diatheses and those in whom symptoms develop with great rapidity.

Both of the patients whose cases are presented herein were under thirty years of age; their histories were of short duration and in each case the disease was a serious one which did not respond to a well managed medical program. In one patient a marginal ulcer developed following partial gastrectomy and it was not influenced by thoracic vagotomy and continued medical management. It was only after removal of an islet cell tumor of the pancreas that this patient was free of symptoms.

One patient (Case I) has been free of symptoms for thirty months following removal of an islet cell tumor of the pancreas and resection of a marginal ulcer. The other (Case II) has been free of symptoms for three months which represents the first relief she has had in two years. In patients with severe ulcer diathesis, when a tumor is not found in the pancreas, resection of the tail and body of the pancreas is advisable.

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Impending Rupture of an Atherosclerotic Aneurysm in a Poor-Risk Patient

RESECTION AND REPLACEMENT WITH A HOMOGRAFT PRESERVED IN 70 PER CENT ALCOHOL

JACOB K. BERMAN, M.D., MAX TAYLOR, M.D., GEORGE M. HAYMOND, M.D. AND VICTOR MORI, M.D.,
Indianapolis, Indiana

From the Department of Surgery, Indianapolis General Hospital, Indianapolis, Indiana.

VASCULAR surgery has made tremendous strides, and conditions which were considered to be hopeless a few years ago are now amenable to surgical treatment. Moreover, what is equally important are the safeguards which modern medicine throws around the desperately sick patient so that operative procedures may be successfully employed.

The purpose of this article is to illustrate the fact that to withhold surgery in otherwise hopeless patients is as great an error in judgment as the performance of an operation on a patient who does not withstand the procedure. This is particularly true in ruptured or impending rupture of abdominal atherosclerotic fusiform aneurysms which rarely occur in otherwise normal patients. Since rupture is usually posterior due to impingement on the vertebral body, there may be a pulsating hematoma for hours or even one to two days. During this time the surgeon must make up his mind whether or not to intervene. There are, in our judgment, no contraindications to the surgical arrest of hemorrhage provided there are no other available methods for its control. A ruptured aneurysm can be controlled only by surgery. After repeated blood volume replacement the case may be hopeless because of widespread anemic anoxemia of parenchymatous organs causing their devitalization. This is often manifested by the presence of anuria not caused by postrenal obstruction. The odds may appear to be against the surgeon who dares to attack an aneurysm that is giving way, yet a sizeable proportion of these patients may be saved from an untimely death and relieved of their discomfort. Some may be entirely rehabilitated. Such was the case of the following patient, who was admitted to the Indianapolis General Hospital on March 19, 1956.

CASE REPORT

H. J., a sixty year old white man who worked as a grinder and polisher, came to the hospital because of excruciating abdominal pain, particularly in the right iliolumbar region but also to a lesser degree in the left lumbar area. He also complained of orthopnea, occasional hemoptysis, edema of the extremities, and pain and discoloration of the left foot. He stated that he had suffered from pain in the abdomen and hip for ten years, and that when he walked a city block he experienced extreme shortness of breath and pain in the extremities, particularly the left.

The more important findings were as follows: (1) a large, fusiform aneurysm of the abdominal aorta, extending from the epigastrium down to the bifurcation; it was extremely tender; (2) hypertension with a blood pressure of 230 mm. Hg systolic and 140 mm. Hg diastolic; (3) extreme bilateral emphysema; (4) an opacity noted on x-ray film in the right upper lobe and thought to be a pulmonary infarct; the metallic fragments in the right wall of the chest were the result of a bullet wound which had been sustained thirty years previously; (5) cyanotic, pulseless left foot; (6) electrocardiographic studies indicating auricular fibrillation with left axis deviation, left ventricular hypertrophy, myocardial change suggesting digitalis effect, and possible old infarction of posterior myocardium; (7) chronic glomerular nephritis.

The patient was thin but he had lost about 20 pounds in weight during the previous six months. He stated that he could not eat because of the pain, nausea and vomiting, but that in the preced-

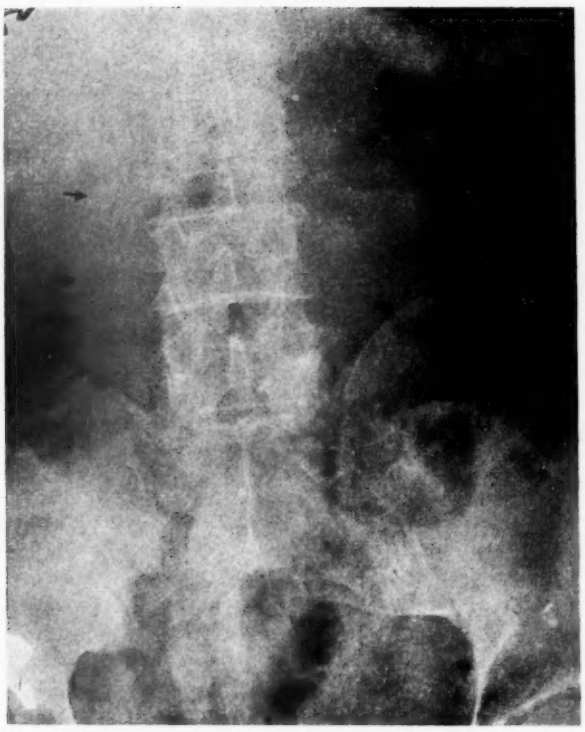

FIG. 1. Preoperative scout film of the abdomen. Note the enormous size of the aneurysm. This shadow is due in part to the large hematoma surrounding the wall of the aneurysm.

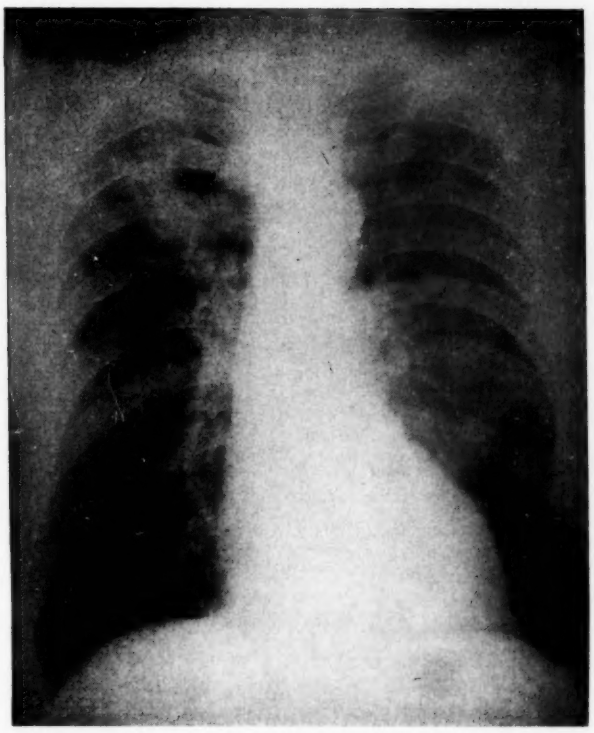

FIG. 2. Preoperative posteroanterior film of the chest. Note the opacity in the right upper lobe and metallic fragments due to an old bullet wound of the chest; also the bilateral emphysema. The shadow was thought to be due to embolism with infarction of the right upper lobe.

ing twelve hours the abdominal pain had become so intense that repeated doses of morphine were needed to control it.

The significant laboratory findings were as follows: X-ray examination of the abdomen showed a large, rounded mass which projected to the left of the lumbar spine, with a calcific border. (Fig. 1.) Erosions of the lumbar vertebrae were not definitely seen on the x-ray. The films of the chest demonstrated bilateral emphysema as well as an opacity in the right upper lobe which was interpreted as being either an infarct or early carcinoma. There were also some metallic fragments adjacent to the area of opacity. (Fig. 2.)

On admission the patient had a hemoglobin of 15 gm. per cent and a leukocyte count of 11,600 per cu. mm., with a normal distribution of cellular elements. The erythrocytes numbered 4,860,000 per cu. mm. These findings were thought to be due to extreme dehydration because of vomiting during the previous three days. The red blood cell count and hemoglobin determinations fell to 2,000,000 per cu. mm. and 8 gm. per cent, respectively, after 2,000 cc. of 5 per cent glucose in distilled water were given intravenously. The voided specimen showed 3 plus albumin with 20 to 25 white blood cells and 10 to 15 erythrocytes per high power field. There were also many hyaline and granular casts. The blood urea nitrogen was 108 mg. per cent, cholesterol 228 mg. per cent, potassium was 5.8 mEq./L., sodium 142 mEq./L., and chlorides 107 mEq./L. The VDRL was negative. The patient was extremely dyspneic and could sleep only in a semi-sitting position.

Our diagnosis was: impending rupture of an atherosclerotic aneurysm with thrombotic occlusion of the iliofemoral artery on the left side.

The patient was obviously a desperate surgical risk. However, we thought that his only chance for survival was through surgery. On March 22, 1956, the patient was operated upon and a large atherosclerotic aneurysm was found which had a hematoma under the adventitia. The following is a description of the operative procedure:

A long midline incision was made which extended from the ensiform cartilage to the symphysis pubis. Exploration revealed a large fusiform aneurysm which extended from 1 cm. below the left renal artery down into the iliac arteries. An incision was made in the left eighth interspace and a ¼ inch cotton tape binding was doubly wrapped around the descending thoracic aorta. The ureters were identified and small umbilical tapes were placed around them. The tape around the thoracic aorta was tightened and the left renal vein dissected off the aneurysm. The aorta proximal to the aneurysm

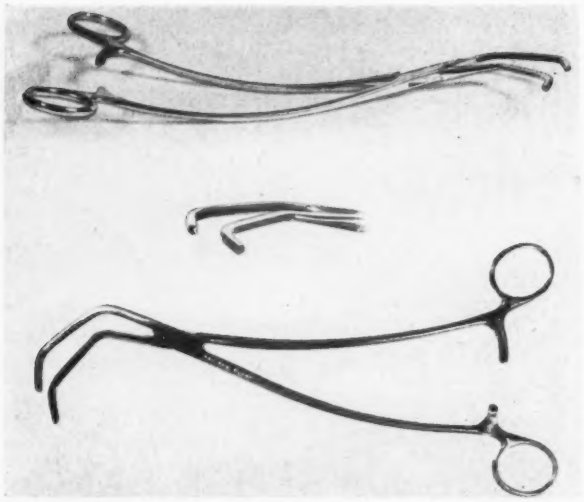

FIG. 3. Vertical clamp used in most of our vascular procedures. The longitudinal curves are made toward the left and the right.

was dissected free. Clamps were then applied immediately above the aneurysm and around both iliac arteries. Figure 3 shows the type clamp which we have been using for this procedure. The lumbar arteries were tied and divided as encountered, and the inferior mesenteric artery was ligated very close to its origin. The aneurysm was then removed except for a very small strip which was densely adherent to the vena cava. A homograft was then inserted, which had been preserved in 70 per cent alcohol for the previous forty-eight hours. Before using the graft it was washed with physiological saline solution and soaked for two hours in a solution of penicillin one million units and streptomycin 1 gm. After the proximal suture line was completed, it was tested by occluding the graft below and loosening the proximal clamp. Next the right iliac artery clamp was released and back-bleeding was noted to be somewhat diminished. However, the intima was studded with atheromatous plaques and endarterectomy was necessary to permit anastomosis. On the left side no back-bleeding occurred because the artery was filled with clot. The clot was removed together with about 3 cm. of intima, and the distal iliac and femoral arteries were aspirated with a catheter. This procedure brought forth brisk bleeding. During the latter procedure the occluding clamp was placed across the left iliac graft, thereby permitting blood to flow freely through the aortic graft down into the right iliac system. Anastomosis was then completed between the left iliac graft and the left iliac artery. Pulsations were normal in both femorals at the conclusion of this procedure. Bilateral sympathectomy was then performed and the abdomen was closed without drainage using silk sutures throughout. The occluding tape was removed from the thoracic aorta and the chest was closed with silk sutures.

FIG. 4. Photograph of the gross specimen which has been opened. Note the laminated clot, and in the right upper portion the site of the rupture.

The following is a description of the aneurysm by Dr. Paul Evans of the Department of Pathology (Fig. 4):

Specimen: Abdominal aortic aneurysm, sympathetic chain.

The specimen was stated to be an abdominal aortic aneurysm, consisting of a partly opened sphere 10 cm. long, 7 cm. deep and 7 cm. wide. The outer surface was dark tan-gray to purple, markedly congested with many fibrous and fatty adhesions but largely covered with a smooth, gray, glistening membrane. On one end two branches were seen to arise, apparently the iliacs; one was 1.5 cm. and the other 0.5 cm. long. They were both markedly sclerotic with yellow, focally calcified walls. These appeared to arise from a dilated lumen that was filled with a mass of laminated, partly organized tan-purple tissue. In the center of this mass one was unable to find intima, there being fifteen or more laminas of varying colors of tissue, apparently thromboses. This dilatation extended 7 cm. and at the proximal surgical margin one could again see gray-yellow, focally calcified and sclerotic intima. Near the proximal surgical margin one could see the intima extending very near the outer layer of the aneurysm, so apparently the laminated mass was a thrombus on the wall of the dilated aortic aneurysm.

Examination of the section through the wall of the aneurysm revealed this to consist primarily of atheromatous material with a thin outer layer of media. Adjacent to the adventitial area were several small nodes, and in other areas no medial layer was

evident; adherent to the atheromatous material was a portion of an old thrombus. In a few areas there was a collection of lymphocytes around small blood vessels in the adventitial area, although these changes were not marked. The slide which consisted of the resected sympathetic chain revealed ganglia with large ganglion cells. The diagnosis was: (1) aneurysm of abdominal aorta with thrombus; (2) normal lumbar sympathetic chain.

The patient had a stormy convalescence. He was oliguric for forty-eight hours following surgery, excreting about 120 cc. per day, and he became extremely dyspneic. The blood urea nitrogen rose to 270 mg. per cent and he became stuporous, then comatose. The auricular fibrillation was more pronounced, but was helped by digitalis and quinidine. On the third day after surgery he began to excrete more urine. He became fully rational on the fifth postoperative day and he asked for food. Seven days after surgery he began having severe diarrhea. This complication persisted in spite of all forms of treatment and was thought to be due to the antibiotics which had been used and which had induced pseudomembranous entercolitis. The diarrhea was controlled after four days with sulfathalidine,® and the patient left the hospital two weeks after surgery.

The patient was observed at home and he continued to improve. The urinary findings cleared remarkably well, and the albumin was reduced to 1 plus, with an occasional white cell and an occasional cast. However, an ulcer soon developed on the left foot. This failed to heal and caused him constant pain; and although there were good femoral pulsations, the ulcer progressed to the point where the great toe of his left foot became gangrenous. Therefore on June 15, 1956, about three months after aneurysmectomy, an amputation of the left lower leg was performed at the junction of the upper and middle thirds. There was brisk bleeding at this site and the stump healed by first intention. At the same time an incisional hernia in the left side of the chest was repaired using wire sutures. There were no complications following this surgery. In February, 1957, the patient's blood pressure was 164/92 mm. Hg. He was readmitted to the hospital on March 12, 1957, because of some difficulty in voiding and because of the persistent density in the right upper lobe. Findings on cystoscopic examination and retrograde pyelography were interpreted as normal. Bronchoscopy showed a normal bronchial tree. All washings were negative for malignant cells and acid-fast bacilli. The cultures showed alpha- and beta-hemolytic streptococci.

Improvement was rapid after the last admission The oval-shaped density in the right upper lung field had decreased in size by June, 1957 (fifteen months after surgery), indicating that it was an infarct or perhaps a localized area of bronchiectasis with scarring due to the old injury. (Fig. 5.) Improvement was rapid after the last admission. The patient was ambulatory with an artificial leg, free from pain and able to work part-time.

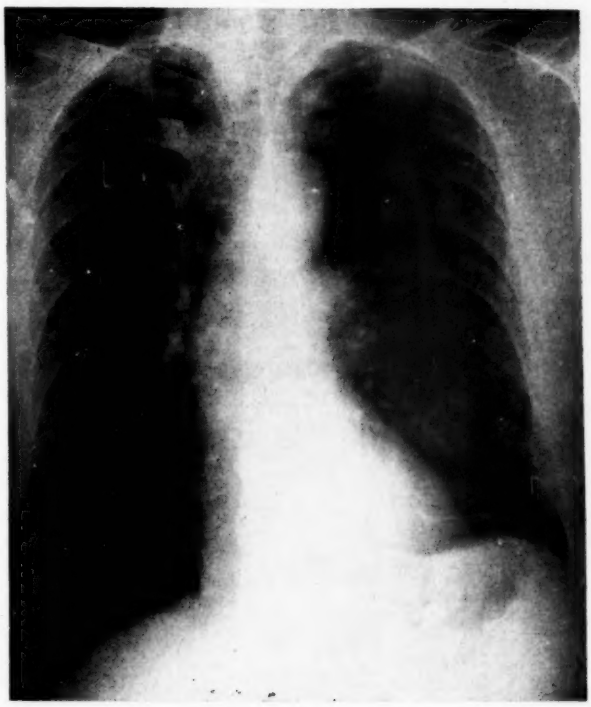

FIG. 5. Posteroanterior x-ray film of the chest taken fifteen months after surgery. The opacity in the right upper lobe has practically disappeared.

The patient was last seen on May 27, 1958, two years three months after surgery. He was working and felt well except for a persistent cough which he attributed to excessive smoking of cigarettes. X-ray film of the chest disclosed no change in the opacity of the right upper lobe.

COMMENTS

Rupture or impending rupture of an aneurysm is a grave emergency and is usually present in poor-risk patients due to associated cardiac, pulmonary and renal disease.

Dissecting aneurysms are often present in more favorable-risk patients and may be treated by the "window" operation as described by DeBakey, Cooley and Creech [1] if resection cannot be performed. This permits the dissecting blood stream which follows the line of medial necrosis to regain entrance into the arterial lumen.

The large, fusiform, atherosclerotic aneurysm with rupture or impending rupture can be helped only by extirpation and graft replace-

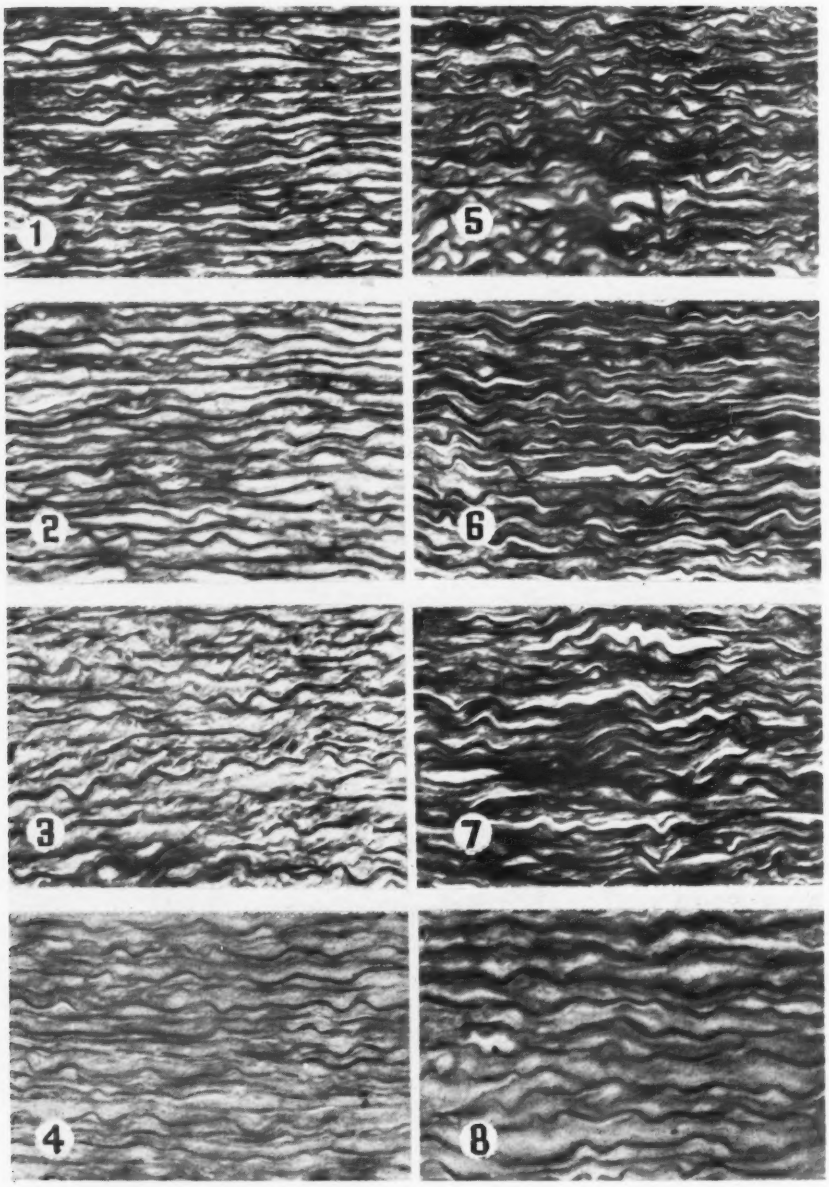

FIG. 6. Human aorta removed from a young adult man who had been killed in an automobile accident. Half of the specimen was preserved in 70 per cent alcohol and the other half in absolute alcohol. Sections were taken at two, six, sixteen and twenty-four weeks, and stained for elastic fibers with Gomori aldehyde fuchsin stain then counterstained with metanil yellow solution. The elastic fibers appear to be better preserved in absolute alcohol up to sixteen weeks. After this time there is little difference. (1) section of human aorta preserved in 70 per cent alcohol for two weeks; (2) same after six weeks; (3) same after sixteen weeks, (4) same after twenty-four weeks; (5) section of the same aorta preserved in absolute alcohol for two weeks: (6) same after six weeks; (7) same after sixteen weeks; (8) same after twenty-four weeks.

ment. At the time of this operation the Indianapolis General Hospital did not have an artery bank. However, a bank is now in operation,* and in addition various types of substitute grafts may be used if desired.

* Supplied in part by the Indiana Heart Fund.

At the time of this study we believed that homografts might be better tolerated by the tissues than prostheses [2]. However, it is now known that homografts probably become calcified earlier than plastic substitutes. Moreover, endothelial proliferation is very limited in all

grafts. The lining appears to be an amorphous material made up largely of fibrinous clot. We were familiar with the experiments of Kimoto [3] and others concerning the use of grafts preserved in 70 per cent alcohol. However, Kimoto had used this method of preservation in only two grafts as a replacement in resected abdominal aneurysms. At the time of his report one of these grafts, which had been preserved for thirteen months, was functioning well thirty-five days after surgery. The other, which was preserved for five months, was working well thirty-five days after surgery. A recent collective review by Lehr and Blakemore [4] does not mention the use of this method of preservation in any other reported cases.

We continued our experiments with alcohol-preserved grafts using 70 per cent and absolute alcohol. Experiments on dogs do not indicate any difference in the efficacy of these methods. However, grafts preserved in 70 per cent alcohol are more pliable. Sterility of the preserved graft is equally assured, and microscopic sections taken at two, six, sixteen and twenty-four weeks indicate equally good preservation of the elastic fibers. (Fig. 6.)

SUMMARY AND CONCLUSIONS

1. Impending rupture or actual rupture of an atherosclerotic aneurysm must be treated by immediate surgery regardless of the apparent deplorable health of the patient or his foreboding symptoms and signs.

2. The poor-risk patient herein reported improved remarkably following resection of the aneurysm and replacement of the abdominal aorta with a homograft preserved in 70 per cent alcohol.

3. Homografts may be preserved in 70 per cent alcohol up to twenty-four weeks without significant morphologic changes in the elastic fibers.

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Phlegmasia Cerulea Dolens

J. Risk Meek, M.D. and James J. Maurer, M.D., *Cincinnati, Ohio*

From the Department of Surgery, Christ Hospital, Cincinnati, Ohio.

Phlegmasia cerulea dolens, sometimes called blue thrombophlebitis, is characterized by acute massive venous occlusion. This process usually, if not always, involves the lower extremities. The reported number of cases is rather small. Manheimer and Levin [*1*] published a paper in 1954 and at that time approximately thirty-two cases had been reported in the American literature. This entity has been reported under various titles but the process is obviously the same. It presents in an extremity as a sudden onset of pain, which is closely followed by bluish discoloration and eventual gangrene. All this occurs even though the peripheral pulsations are present and palpable.

The purpose of this paper is to report a case of phlegmasia cerulea dolens and the findings at necropsy and also to postulate a new theory and etiologic factor in the pathogenesis of this disease.

CASE REPORT

M. W. (Hosp. No. C-37722), a sixty-one year old white woman, was admitted to Christ Hospital on September 17, 1957. Two weeks prior to admission abdominal pain developed which progressed to anorexia and vomiting. The vomiting usually occurred two hours postprandial and consisted of undigested food. Several days prior to admission she noted swelling of the ankles, the right more than the left. Approximately four to five years previously she had suffered painful, whitish swelling of both legs. This occurred after traveling a considerable distance in an automobile. The swelling subsided with conservative treatment.

On physical examination, the blood pressure was 124/72 mm. Hg, temperature 99°F., pulse 92 and respirations 20. The patient was a well developed but poorly nourished white, elderly woman who appeared acutely and chronically ill.

The pertinent findings were a soft and scaphoid abdomen with a 6 cm. mass palpable in the left upper quadrant. This mass was tender to palpation and also mild tenderness was noted over the entire abdomen. Bowel sounds were normoactive. The extremities showed slight pitting edema of the ankles, the right side more than the left. Arterial pulses were equal and of good quality.

Laboratory data on admission were: red blood cells 3.87 million per cu. mm., hemoglobin 12 gm. per cent, white blood cells 20,500 per cu. mm. with 87 per cent neutrophils, 1 per cent eosinophils, 4 per cent lymphocytes, and 8 per cent monocytes. Fasting blood sugar was 144 mg. per cent, blood urea nitrogen 5 mg. per cent, urea 11 mg. per cent. No serum amylase was found. The patient was treated with Pro-banthine,® phenobarbital and Dicrysticin.® An upper gastrointestinal series showed prolapse of the gastric mucosa into the duodenal cap. There was a questionable ulcer niche and considerable spasm in the second portion of the duodenum. Barium enema disclosed diverticulosis of the whole large bowel. From the time of admission until September 23, 1957, the patient complained of a dull, aching abdominal pain, and continued to vomit. The temperature was essentially normal but the white blood count remained elevated. Attempts to localize the abdominal mass by x-ray examination were to no avail. On the morning of September 23, it was noted that the right calf and foot were swollen, tender and pale. Pulses were of good quality in the femoral, posterior tibial and dorsalis pedis arteries; a diagnosis of thrombophlebitis was made. The prothrombin time was reported within the normal range and the patient was given Hedulin® as an anticoagulant. After an initial dose of 200 mg. the prothrombin time was reported as normal. The following day Hedulin was given as a maintenance dose of 25 mg. plus 12.5 mg. Following this the prothrombin did not jell in two minutes. A fibrin skein floating in the liquid formed in forty-three seconds. On the same date, September 25, the patient experienced a sudden onset of severe

* Currently on active duty at the United States Naval Hospital, St. Albans, New York.

pain in the lower portion of the right leg and foot. It was also noted that along with pain, cyanosis of the right foot had suddenly developed. A diagnosis of acute arterial embolus was abandoned since all the peripheral pulses were present and essentially equal to those in the left extremity. Following the report of the markedly abnormal prothrombin time, 25 mg. of Mephyton® were given intravenously. The prothrombin time was then reported as within the normal range. Aqueous heparin, 50 mg., was given every four hours for a total of eight doses. The cyanosis remained and the ecchymosis progressed to about the junction of the upper and middle thirds of the tibia. Some blanching and bleb formation were also noted. The edema progressed; however, the dorsalis pedis pulse was still present although slightly diminished as compared with the left foot. Severe pain, coldness and cyanosis continued, and on September 30, it was noted that frank "black" gangrene was present in the toes. Up to this time the whole foot and lower leg was a bluish-purple color. The patient showed progressive lethargy and the foot passed to an almost devitalized state. On October 2, 1957, a right supracondylar amputation was performed. Following surgery the patient never seemed to be aware of her surroundings. A consultant in psychiatry thought this to be due to recent organic injury within the brain. A white blood count on October 9, revealed 33,800 cells per cu. mm. with 92 per cent neutrophils. The patient's temperature became elevated on October 11, the blood pressure began to fall and she continued on a down hill course. She died on October 14, 1957. An autopsy was performed.

Laboratory studies were as follows: On September 26, 1957, the bleeding time was one and a half minutes and the clotting time was four and a half minutes. The platelet count was 111,000 per cu. mm. The plasma prothrombin time was fifteen seconds (normal range thirteen to fifteen seconds.) The serum prothrombin time was eighteen seconds (normal range twenty-five to fifty seconds). The clot retraction was complete in twenty-four hours and there was no lysis of the clot. On September 28, 1957, the total proteins were reported as 5.6 gm. per cent, albumin 3.6 gm. per cent, globulin 2.0 gm. per cent, and an A/G ratio was 1.8. No Bence Jones protein was found in the urine. Daily bleeding and clotting times up to the time of death were normal. Shortly after the onset of cyanosis the patient was seen by Dr. Louis G. Herrmann and blood was obtained for the detection of a cold precipitable protein and paper chromatography of the serum proteins. Another such study was carried out the next day. The prothrombin time on the first blood sample was infinity. At this time 23.4 mg. per cent of fibrinogen were detected 200 to 400 mg. per cent being the normal range. The clotting mechanism of this blood was studied in the following manner. To 0.1 ml. of this oxalated whole blood was added 0.1 ml. of 0.02 M. calcium. There was no clotting in twenty-four hours. A control, using 0.1 ml. of normal oxalated whole blood and 0.1 ml. of 0.02 M. calcium, was observed to clot in one and a half minutes. The plasma prothrombin time on the first sample of blood from the patient was recorded as one minute forty-eight seconds. When 0.1 ml. of fibrinogen was added to the plasma, the prothrombin time was found to be fifteen seconds, almost normal. The T.A.M.e. assay [2], which measures plasma prothrombin, was reported as 3 units on the patient's first blood sample. On the following day, the prothrombin was normal. Fibrinogen in the amount of 132 mg. per cent was detected and the T.A.M.e. assay was 32 units, the normal value being about 53 T.A.M.e. units. It was also noted that a precipitate formed when the oxalated plasma was cooled to 5°C. This precipitate was found to have the same paper chromatographic band as fibrinogen.

According to the pathologists report of October 2, 1957, the amputated right leg showed dry mummification of the toes and plantar surface. Blebs on the sole and over the ankle and calf area contained blood tinged fluid. The skin was mottled with a lavender to purple color over the external malleolus and extending on the mesial and posterior surfaces up to the mid-calf. Sections taken at various levels all showed the veins to be thrombosed throughout the whole leg, while the arteries were patent. There was, however, medial sclerosis and calcification of the arteries. Also observed was a tendency toward the union of small arteries and small veins into a common group of tubules. The important finding was a total and complete thrombosis of the venous side of the circulation.

The autopsy report of October 14, 1957, was as follows: Upon opening the abdomen there was a tumor mass adherent to the peritoneum and also disseminated throughout the abdominal cavity. The small and large intestines were fused to the tumor mass. However the mucosa of both was not involved. The liver weighed 2,260 gm. and almost 60 per cent of it was replaced by tumor nodules. The pancreas was almost entirely replaced by tumor with very little recognizable pancreatic tissue. There was complete thrombosis of the right iliac vein, the thrombus extending up into the inferior vena cava as high as the level of the renal vessels. There was indefinite softening of the left occipital lobe of the brain. An infarction of the left lung was identified.

The two primary lesions were: (1) carcinoma of the pancreas with generalized abdominal carcinomatosis and (2) phlebothrombosis of the right iliac vein, inferior vena cava and right renal vein.

COMMENTS

Anderson [3] lists the following causes of thromboses: (1) injury to the vessel wall, (2) toxic effects, (3) infection or inflammation, (4) stasis and (5) increased coagulability of the blood. The association of venous thrombosis and carcinoma of the pancreas was brought out by Mikal and Campbell [4], especially, the incidence of thrombosis being as high as 48.5 per cent in 100 autopsy cases in which carcinoma involved the body and tail of the pancreas. As stated earlier, the disease usually involves the lower extremities. However, Swartley et al. [5] described a case of thrombosis of the vessels in the arm progressing to gangrene of the hand even though the radial pulse was of a good quality. Oscillometric studies comparing an involved with an uninvolved lower extremity have shown essentially the same readings [6], tending to indicate that the lesion is not one of arterial impairment. A variety of opinions are encountered as to the site and nature of the basic lesion. DeBakey and Oschner [7] believe that arterial spasm contributes a major component, while Manheimer and Levin [1] consider venous spasm to play a major role in the pathogenesis of this syndrome. However, Veal [8] believes that arterial spasm of some degree may occur, but blockage of the venous outlet causes the most difficulty. It is our opinion that the blockage of the venous outlet does cause the major problem. This blockage is very effectively caused by the complete thrombosis of all the veins of the involved extremity. One might call this an "internal tourniquet" applied to the venous circulation of the leg. Evidence for such an opinion is found in the pathologic report on the amputated right leg of this patient. An explanation for the pain could then be muscle anoxia. A known fact is that a deficient oxygen supply to muscle results in pain, and in this case the venous occlusion was the mechanism by which anoxia was produced. The occlusion being continous, it is only natural that gangrene should follow. DeBakey and Oschner [6] state that many methods of treatment have been tried, but amputation is usually the final course.

The factor which causes the apparent sudden venous occlusion has never been definitely elicited. Veal [8] states that it has been observed after vein ligation and also after vein injection. However, Miles [9] states that the condition has improved after vena cava ligation. In this case there was no direct acute trauma or insult to the extremity or its vessels. Evidence of previous disease in this extremity was present in the nature of a non-inflammatory swelling. From the laboratory data it was observed that circulating fibrinogen was essentially absent. This occurred in close correlation to the onset of symptoms and thrombosis in the right leg. It is our belief that the circulating fibrinogen was incorporated in the formation of the venous thrombosis of the leg. By this mechanism the circulation was depleted of fibrinogen. The cause of the defibrinogenation is not apparent; however two factors may play some role in it. A large pancreatic tumor was present and its association with venous thrombosis is well established. The possibility of a thrombogenic agent arising from the tumor and precipitating the thrombosis cannot be discounted.

In the laboratory studies it was noted that the oxalated plasma, upon which the second fibrinogen determination was made, contained a cold precipitate. This precipitate was very similar to fibrinogen. The determination was not unlike that carried out by Korst and Kratachvil [10] who reported a case of thrombophlebitis migrans in a patient with lung tumor. It was in this patient that they detected a cold precipitable fibrinogen which they termed "cryofibrinogen." Smith and Von Korff [11] also reported the presence of a cryoprotein or heparin-precipitable fraction in the blood of patients with certain infectious or inflammatory disease processes. We do not believe that the pancreatic tumor, cryofibrinogen and phlegmasia cerulea dolens can be correlated with any degree of certainty. It is only our hypothesis then, that the tumor was, in some way, connected with the formation of the cryofibrinogen. This in turn was associated with the massive venous occlusion. As previously mentioned this triad has been reported by Korst. We should like to add this case and suggest that the relation is more real than is apparent.

In conclusion, the hypothesis that the tumor and the cryoprotein are related to the pathogenesis of phlegmasia cerulea dolens is forwarded. It is needless to say that further work will be needed to provide more conclusive evidence.

SUMMARY

1. A case of phlegmasia cerulea dolens is reported.

2. Massive venous occlusion is associated with a defibrinogenation of the circulating blood.

3. An hypothesis is forwarded that a pancreatic carcinoma, a cryofibrinogen and the pathogenesis of phlegmasia cerulea dolens may be related.

4. The pain of this disease process is probably due to an acute anoxic state involving the muscles of the lower extremity.

5. The gangrene is due to the complete thrombosis of all the veins acting as an internal tourniquet on the diseased leg.

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Recklinghausen's Disease with Urinary Manifestations

NEUROFIBROMA OF THE BLADDER

TH. BURGHELE, M.D., H. IOACHIM, M.D. AND J. GOLDSTEIN, M.D., *Bucharest, Roumania*

From the First Surgical Clinic, Bucharest, Roumania.

MULTIPLE neurofibromatosis, a disease which was classically described by Tilesius, Smith and von Recklinghausen in 1882, is mainly known to dermatologists because, notwithstanding its bone, visceral and neuropsychic manifestations, we are accustomed to its more common localisations in the skin. The syndrome is quite rare and the report on 227 patients by Crowe, Schull and Neel [3] after a sixteen-year study of a large number of patients at the Michigan University (1934–1950) affords interesting conclusions as to the clinical aspects and frequency of this disease. Recklinghausen's disease seems to have, according to extensive statistical inquiries, a frequency of 1 per 2,500–3,300 births, that is 3 to 4 per cent.

In its classic form the syndrome comprises spots and tumours of the skin, visceral and central nervous system localisations, numerous bone malformations as well as mental disorders of the deficiency type.

Most commonly, however, the disease has a quiescent course, characterised by localisations in the skin or, much less frequently, a visceral tumour which by its possible size may dominate the clinical syndrome—"the royal tumour"—the symptoms being those of the organ involved. Most frequent among visceral localizations are those in the digestive tract. In 1956 Audoin and Lataste [1] reported a neurinoma of the rectum which, together with an additional eight similar cases, make up the whole literature of the last thirty years, while in 1957 Desjacques and Kermarec [4] presented, as an equally rare manifestation, a schwannoma of the small intestine in a woman with signs of multiple neurofibromatosis. Even less frequent than these rare digestive tumours is neurofibromatosis of the bladder. Hückel [5], in a study published in 1934, mentioned three cases known up to that date. Among these are: (1) the case of Gerhardt, who described for the first time in 1878, in a patient with generalised neurofibromatosis, tumoral nodules in the cervix of the bladder; (2) that of Steven (a fibroneuroma of the vesical trigonum); and (3) that of Heusch who did the first cystoscopy in a case of Recklinghausen's disease with vesical localisations. We have not found any similar observations histologically confirmed. The recent investigations on a wide series of vesical tumours published by Melicow [6] in 1955 (2,500 cases) and Mostofi [7] in 1956 (2,678 cases of vesical tumours) did not include any case of neurofibroma of the bladder.

CASE REPORT

The patient treated by us, A. P., a woman aged twenty-eight, was admitted to the Urological Clinic with pains in the lumbar region, polakyuria and pyohematuria.

From the history we learned that her father was healthy, as was one living brother, but her mother had died of a malignant growth of the cervix uteri.

Menstruation had started when the patient was fifteen years of age, and was regular and painless.

For approximately one year the patient had been suffering from lumbar pains, sometimes appearing as colic, polakyuria with diurnal predominance and repeated hematuria.

Because a genital tumour with urinary complications was suspected, the patient had been operated upon in the gynecologic department of a hospital. Subumbilical medial laparotomy was performed and a tumour was found which appeared to involve

FIG. 1. Urography.

the bladder. Two tumoral nodules were excised, both being the size of a green nut, situated behind the os pubis. Microscopic examination showed neurofibromatosis.

Clinical examination revealed stains of light-brown "coffee and milk" color, with a diameter of 2 to 5 cm. spread over the thorax, abdomen and lumbosacral regions, sharply delimited, sometimes confluent.

On the dorsal thoracic (lower third) and sacrococcygeal regions numerous small tumours of the skin were seen. The sizes varied from 0.5 to 1.5 cm. The consistency of the tumours was soft; some were pediculated and covered with normal skin. Minute palpation revealed small subcutaneous tumours the size of peas, which were elastic and covered with normal skin, were painless and were localised on the outer surface of the hips, legs, forearm and abdomen.

The symmetry of the glutaeal region was deformed by an excess of soft tissues on the right side.

Examination of the urinary tract yielded the following data: The patient passed urine once every hour, less frequently at night. The urine was cloudy and sanguineous, with small blood clots. The kidneys could be felt; they were enlarged and painful.

Cystoscopy revealed a tumour of the vesical trigonum, with an irregular surface; the mucous membrane was ulcerated and presented suffusions of blood. The ureteral apertures were inapparent. The tumour was easily felt by bimanual palpation, and seemed to be the size of an orange.

FIG. 2. The lumbosacral area with deformity of the soft tissues on the right side.

Laboratory tests gave the following results: blood urea 0.80 gm. per cent; erythrocytes 2,800,000 per cu. mm., with 50 per cent hemoglobin; leucocytes 8,800 per cu. mm.; erythrocyte sedimentation rate: 45 mm./1 hour, 79 mm./2 hours.

Urography (Fig. 1) showed that secretion was going on bilaterally. The pyelocalyceal cavities on the right side were distended. The right pelvic ureter was much distended. The pyelocalyceal cavities in the left side were lightly distended.

The left pelvic ureter was greatly widened above a juxtavesical stenosis and an intramural calculus. The bladder was large, slightly opacified; a large density of soft tissue intensity was projected on its top.

The patient's fever presented the specific curve of urinary infections. The general condition was

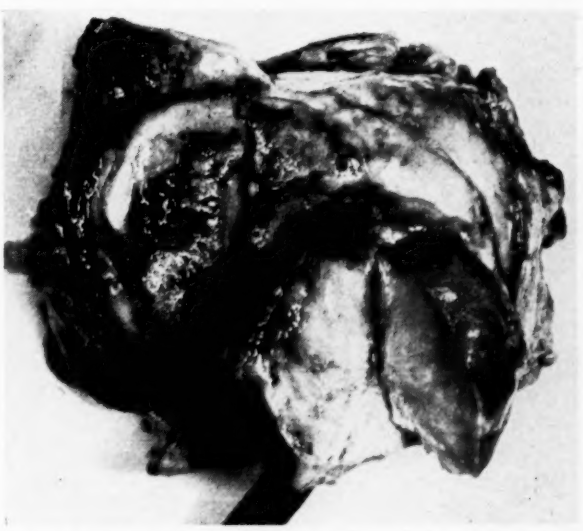

FIG. 3. Opened bladder. The mucosa is of irregular aspect because of a great number of underlying tumours. Visible in the lower right area is a large tumour that has been sectioned.

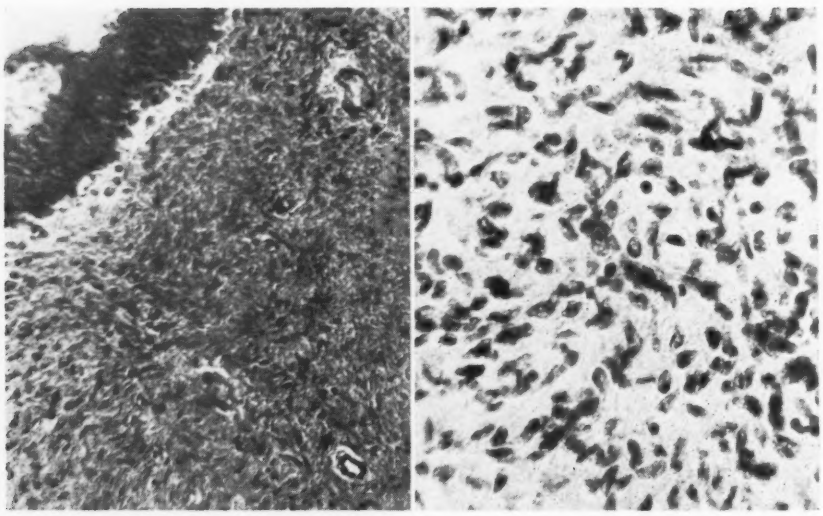

FIG. 4. Microscopic features of the tumour of the bladder. Left: neurofibromatous tumoral tissue situated below the bladder mucosa (upper left). Right: lengthened, band-like neurofibromatous nuclei.

rather altered. The microscopic examination of a tumoral fragment confirmed neurofibromatosis.

In spite of the treatment (antibiotics, vitamins, etc.), the patient died two months after admission with symptoms of renal failure.

At necropsy numerous stains of light brown "coffee and milk" colour were seen which were of variable sizes and irregularly spread, as well as the frequent pediculated or sessile cutaneous tumours already described. There was excessive pilosity of the lumbosacral region. Soft tissues were also in excess, giving rise to a large excrescence which modified the symmetry of the region, the general anatomic structure being, however, preserved. (Fig. 2.)

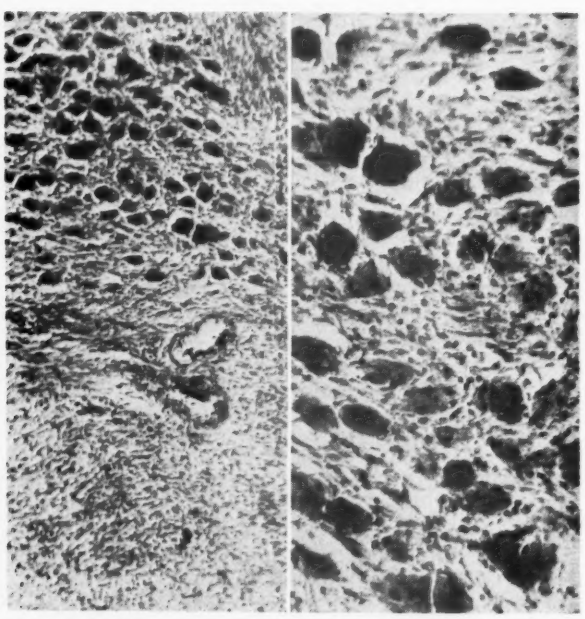

FIG. 5. Microscopic features of the tumour of the bladder. Left: vegetative microganglion amid tumoral growth. Right: cells of sympathetic type in the neurofiromatous tissue.

On opening of the thorax the lungs appeared to be normal. The heart did not show any macroscopic alterations; its valvular system was normal

In the abdomen we found that the liver was afflicted with fatty dystrophy and several calcified subcapsular nodules. The spleen was small and flaccid. There was gastric and intestinal meteorism. The left kidney was of increased size, hydronephrotic with dystrophic alterations of the parenchyma.

The ureter was greatly distended, reaching the size of an intestinal coil. The same aspects of ureterohydronephrosis were found on the right side.

The bladder adhered to the vagina and the cervix uteri through a fibrous formation starting from the bladder wall and which, on section, appeared to be white and dense. The vesical mucus was ulcerated and hemorrhagic, and overcapped a series of confluent tumours of variable sizes. (Fig. 3.) The largest was the size of a tangerine, its site being the vesical trigonum with a tendency toward obliterating the left ureteral aperture.

No other involvements of viscera could be found macroscopically.

Microscopic examination of the cutaneous tumours disclosed the presence of somehow circumscribed formations localised below the epidermis, which was thinned at their level. There was no distinct boundary separating the formations from neighbouring tissues, the formations sometimes including in their proliferation sudoriferous and sebaceous glands as well as hair follicles and blood vessels.

The tissue of which they were made up was rich

in cells with indistinct limits, with elongated, undulant parallel nuclei, and forming fascicles which crossed each other, or small whirlpools.

The light brown stains showed the normal features of the tissue with a relatively rich melanic content of epidermal basal cells.

Histologic sections of the vesical tumours (Figs. 4 and 5) showed a thin hemorrhagic and ulcerated mucous membrane which, on wide stretches, disappeared altogether. The tumour had the aspect of adult connective tissue with multiple nodules in whirlpools, similar to schwannian structures. Poorer as regards cells, which are similar to those found in the epidermal tumours, they comprise more collagenous tissue, stained electively with picric acid and acid fuchsin by the Van Gieson technic.

In some areas we found fascicles of nerve fibres included in the gliomatous tissue. A special aspect was that of nodules formed by groups of vegetative cells reminding of microganglions. These formations were quite frequent in some parts of the tumour and their ten to twenty large mononuclear cells were surrounded with numerous nerve fibres, the whole being included in the glial and connective tissues of the tumour.

The tumour was not encapsulated, nor did it have any distinct limits. It penetrated into and dissected the muscular wall of the organ, involving also the muscular layers of the vagina and of the cervix uteri, where the same interpenetration of neurofibromatous tumoral tissue and local muscular fibres could be noted.

COMMENTS

From the description of the histologic aspects found in both the cutaneous and the vesical tumours—localised in our case in the vesical trigonum—one may note that each nodule represents a distinct tumoral growth because of the glial tissue constituting the sheath of Schwann of the peripheral nerves within the respective territory. Glial proliferation is always associated with that of the connective tissue constituting the outer cover of the nerves.

Although in early nodules the schwannian elements are predominant, producing the characteristic histologic features (whirlpools or "Verocay nodules," the "ribboned" aspect of nuclei, the staining of "π granulations" in cells without distinct limits appearing as syncytia), in adult tumours connective proliferation becomes predominant, doing away with the previously described aspects and transforming reticulin into collagenous tissue which grows until it is exclusive, thus giving rise to genuine fibroma in long-standing nodules.

What seems to be unusual in our case is the participation in the proliferative process, along with glial elements, of vesical vegetative ganglion cells forming genuine intramural vegetative nodules.

Macroscopically, the neurofibromatosis of the bladder usually localised in the trigonal zone may appear either as a unique, large tumour or, more frequently, as multiple submucous tumours which when very small give the cystoscopic aspect of cystitis cystica.

Quite often the mucous membrane which is intact at the beginning covers the growth and becomes ulcerated by the increase in the size of the tumour, which obliterates the vessels thus producing ischemia. Just as it happened in our case, ulceration is followed by infection which aggravates the already poor general condition of the patient, who at this stage has already been afflicted by ureterohydronephrosis through involvement of the ureteral apertures Sometimes the central ulcerated cavity communicates through a narrow trajectory with the lumen of the bladder; this is the so-called "sand-watch" aspect which favours septic retentions. The malignant transformation of tumours in Recklinghausen's disease, although reported in variable proportions by various authors, occurs in only 2 to 16 per cent of the cases. Nevertheless the tumours have a marked tendency toward invasion which makes possible their extension to neighbouring tissues, which then dissociate and involve or destroy through their exuberant proliferation.

In Audoin and Lataste's case of neurinoma of the rectum which invaded perirectal tissues [1], in other reports found in the literature and in our case in which proliferation involved the wall of the bladder, the perivesical tissues and the vagina, there was no plane of dissection; the tumoral growth invaded the neighbouring tissues just like a malignant tumour, sometimes even drawing them as it seems actively into the growing process. In other cases massive non-malignant adherences may ultimately connect the tumour with the neighbouring organs.

Other interesting lesions also produced by the tumoral proliferation are the bone alterations usually accompanying multiple neurofibromatosis, which result in varied hyper- or hypodevelopments of a limb, the sternum or the mandible, or in the production of cysts or bone erosions, pseudarthrosis and bone curvings.

The precise mechanism is as yet unknown, but it seems probable that the tumoral proliferation decreases the blood supply of the bone in certain zones and increases it in others, produces deficiencies of the trophic nerve supply or simply osteoporosis through compression and an invasion tendency.

By its dysplasic features as well as by its extension to so many organs and tissues, Recklinghausen's disease, although classified as a benign tumour, is of great severity. The disease is certainly congenital (even hereditary, according to most authors), similar troubles being present in at least 50 per cent of the related individuals, mainly among collateral relatives of the first degree and among descendants.

It is a complex dysplasia, a neuroectodermosis with tumoral neoformations usually involving the neighbouring mesodermic tissue. Caillau [2], together with other authors, associates it with similar syndromes such as Bourneville's disease or tuberous sclerosis, Lindau's disease or encephalotrigeminal angiomatosis, etc.

From the point of view of medical practice, distinction must be made between the less frequent visceral forms and those in which cutaneous and medulloencephalic troubles are predominant. The clinical forms with a great number of cutaneous tumors (9,242 were found in one case; Seclacov [10]) usually lack important visceral localisations.

As regards visceral growths, the diagnosis is more difficult because the idea of neurofibromatosis is frequently suggested by several discrete light brown maculae only. The macroscopic aspect of the nodules is frequently noncharacteristic, similar to that of fibroma, mainly in those cases in which there is transformation in connective collagenous tissue.

Whenever we find a visceral tumour on an unclear structure and small cutaneous tumours with the already known presence of more than five "coffee and milk" stains at least 1.5 cm. in diameter, we must think of multiple neurofibromatosis (Crowe, Schull and Neel [3]).

Under these conditions the probability of Recklinghausen's disease grows considerably (78 per cent of the patients present the characteristic stains under the given circumstances), and the visceral tumour, more frequently with a thoracic or digestive localisation and less frequently but nevertheless possibly vesical as shown in our report, must be integrated into the general description of the disease. In a disease with a high percentage of non-symptomatic forms (in the literature 18 per cent of the patients consulted a physician for cosmetic reasons while 28 per cent came because of symptoms unrelated to the main disease) it is always useful to bear in mind a few data necessary for a correct diagnosis.

SUMMARY

A clinical and histopathological record of a case of Recklinghausen's disease, with a rarely encountered localisation in the bladder, finally leading to the patient's death, is followed by general considerations of the clinical and pathological features of the disease, its frequency and prognosis.

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Non-penetrating Trauma to the Biliary Tract

CHARLES H. MANLOVE, JR., M.D., FRANK W. QUATTLEBAUM, M.D. AND LASZLO AMBRUS, M.D.,
St. Paul, Minnesota

INTRA-ABDOMINAL injuries following blunt trauma to the abdomen are common entities in any large hospital emergency room. Injuries to some part of the biliary tract are consequently being encountered with increasing frequency and as such must be considered in the differential diagnosis of acute abdominal pain following trauma. Some interesting aspects of trauma to the biliary tract and the appropriate treatment of these lesions will be considered herein.

OBSERVATIONS

Injuries to the abdomen which are of such magnitude to produce a ruptured viscus without also producing a penetrating wound of the abdominal wall are associated most frequently today with automobile accidents. A few such injuries occur as a result of body contact in the pursuit of various athletic endeavors or as a result of falling from high places. Generally such a force causes compression and sudden flexion of the trunk, thereby putting undue strain on whatever viscus is located in line with the force.

The spleen and liver are injured more frequently as a result of blunt trauma than any other viscus in the abdominal cavity, with injuries to the gastrointestinal tract being next in frequency. Non-penetrating injuries to the abdomen causing rupture of the gallbladder are rare medical entities, there being only about fifty reported cases in the literature. Norgore [*6*] reviewed the subject in 1946. When this injury is associated concomitantly with an injury to the liver, the combined lesion is even rarer, the first case being reported in 1948 [*5*]. Only one other reported case [*8*] has been found. Penetrating wounds, on the other hand, such as those caused by high velocity missiles or knives, may perforate any structure within the abdominal cavity.

Injuries to the gallbladder may be classified into three groups: (1) contusion, (2) avulsion and (3) laceration.

It is conceivable that contusion of the gallbladder, along with contusion of other organs, may occur much more often than is recognized. This injury undoubtedly is associated with only vague or temporary signs and symptoms. No specific therapy would be indicated other than observation and general supportive care. To prove such a diagnosis without surgery would be almost impossible.

With an avulsion of the gallbladder, the organ is torn out of its bed in the liver and may be found lying free in the abdominal cavity except for its attachment to the common duct and hepatic artery. A volvulus of the organ may be present, and if this is severe, the organ may become gangrenous and develop a perforation.

A laceration or tear of the gallbladder allows free flow of bile into the peritoneal cavity with resulting bile peritonitis. Benson and Prust [*1*], who discussed a case of a three year old child with a trivial external injury and a tear of the gallbladder, believe that sterile bile in the peritoneal cavity is not nearly as serious or irritating as infected bile. The signs and symptoms of peritonitis due to sterile bile may take thirty-six hours or more to develop, thereby making the early detection of this condition difficult.

In the majority of cases reviewed in which a rupture of the gallbladder was present, the diagnosis of an acute condition of the abdomen was not made until thirty-six hours or more after injury. This was due either to the fact that the patient had other more serious injuries which masked the injury to the biliary tract, or that the biliary symptoms were vague and not considered initially. Failure to suspect this diagnosis, and thereby depriving

the patient of exploratory laparotomy, may result in fatality. Prior to 1898 there was not a single reported case of survival from a ruptured gallbladder either with or without surgery. Since that time there has been only one known fatality in the group which was treated surgically [8].

When bile is infected the signs and symptoms of peritonitis are much more dramatic and appear sooner. In addition to the bacteriological components it is thought [5] that bile in the peritoneal cavity produces its toxic manifestations because the bile salts and acids are irritating and produce a decreased circulatory volume with its ensuing shock. Bile peritonitis carries with it a mortality rate of 50 to 75 per cent.

The signs and symptoms associated with a rupture of the liver are those associated with any intra-abdominal hemorrhage and depend on the rapidity and quantity of blood loss. These symptoms consist of varying degrees of pallor, sweating, tachycardia, hypertension, restlessness, thirst, and also include pain and tenderness. Sengstaken [7] points out that x-ray examination of the abdomen usually cannot be relied upon to give a positive diagnosis of a ruptured liver or gallbladder, but is extremely helpful in ruling in or out an associated hollow viscus injury.

The treatment of a ruptured gallbladder may be handled in one of three ways, namely, cholecystectomy, cholecystostomy or simple suture of the laceration of the gallbladder.

The type of surgical treatment employed will depend upon the condition of the patient, the size of the tear in the gallbladder and the general condition of the gallbladder itself. In general, if conditions are at all favorable, the gallbladder should be removed. To leave the gallbladder in may result in re-exploration, particularly if the gallbladder is more seriously injured than suspected. It is conceivable that such an injury could result in the organ becoming non-functional and forming stones secondary to an infection from the original injury. Certainly if stones are present and the patient's condition is satisfactory, the gallbladder should be removed. With proper surgical handling recovery is usually swift and uncomplicated.

The treatment of a ruptured liver may be handled by either suturing the laceration or packing it, if bleeding is so extensive that suturing will not control it. No specific treatment may be necessary after the injury is visually inspected if the bleeding has ceased and does not seem likely to start again. The use of gelfoam® packing to control hemorrhage is very helpful. Occasionally bleeding will be so extensive that it is necessary to pack the wound with dry gauze which may be removed at a later date after the bleeding has subsided. It is not uncommon for exsanguination to occur before the patient reaches the hospital following a rupture of the liver.

A slough of part of the liver is seldom seen. In order for this to occur a large portion of this organ must be deprived of blood supply. It is difficult to imagine the manner in which an external force would have to be applied to produce such an injury. It is conceivable that following a severe contusion of the liver in which part of the blood supply is damaged, there is sufficient reduction of the normal protective and regenerative functions so that a secondary infection may develop and cause a progressive destruction of liver tissue, thereby allowing a slough to occur. If the injury is extensive, a sufficient decrease in liver function could occur to cause death.

Occasionally the common bile duct becomes lacerated by non-penetrating abdominal injuries. If the tear is a linear one it may be treated as any choledochotomy wound by T tube drainage and suturing. If a transverse tear or complete loss of continuity is present, the laceration may be approximated with fine silk sutures over a long-armed T tube which is brought from the common bile duct in an area that is not damaged.

The following case is presented to illustrate some of the problems of non-penetrating trauma to the biliary tract. This is the first known case of a traumatic rupture of the gallbladder associated with a slough of part of the liver.

CASE REPORT

This forty-three year old white woman was admitted to Ancker Hospital on the afternoon of September 6, 1957, following an automobile accident. She was a pedestrian and while crossing the street was struck by a car with such force that she landed first on top of the car and then fell to the street. The patient was of foreign extraction and an adequate history was difficult to obtain. She complained of severe generalized abdominal pain but there was no nausea or vomit-

ing, and she had had no biliary tract symptoms previously. Physical examination of the abdomen revealed marked pain, tenderness and rebound tenderness, associated with involuntary muscle spasm and guarding in the upper abdomen. No abnormal abdominal mass could be detected. In addition to the abdominal findings, she had multiple fractures including the neck of the right humerus, the right side of the pelvis, and the mandible at the symphysis and at the left articular condyle. The transverse process of the third lumbar vertebra was also fractured and there was a possibility of some rib fractures on the left side.

Her general condition, despite the fractures, was good. Blood pesssure was 120/70 mm. Hg, pulse 90, and respirations 20. Hemoglobin was 13.1 gm. per cent and urinalysis was essentially normal. X-rays of the abdomen failed to reveal any free air in the peritoneal cavity. The diaphragms were both in normal position and there were no obvious rib fractures, hemothorax or pneumothorax.

A tentative diagnosis of a ruptured abdominal viscus, possibly liver or spleen, was made and she was taken immediately to the operating room for exploratory laparotomy.

The peritoneal cavity was opened through a right upper rectus incision and bile-tinged fluid was immediately encountered. The patient had a rupture of the fundus of the gallbladder, and numerous small mulberry stones were scattered throughout the upper abdominal cavity. Exploration of the remainder of the abdomen failed to reveal any significant abnormalities. There was no penetrating abdominal wound. Because of the presence of stones and since the patient's condition was stable, the gallbladder was removed. This was accomplished without incident, and a Penrose drain placed in the gallbladder fossa was brought out through a separate stab wound in the abdominal wall. The bed of the gallbladder was closed with a running 3-0 chromic catgut suture.

Postoperatively the patient did well, although she was confined to bed for a much longer period of time than would normally be expected because of her various fractures. The Penrose drain was removed on the sixth day, there being only a small amount of drainage at this time. The only significant abnormal event in the patient's postoperative course was that she continued to drain bile-stained fluid. Following the third week of her first operation, the drainage became thick and semi-purulent although no organisms could be cultured. The sinus tract was probed on several occasions and there was only a minimal increase in the amount of drainage. This drainage was not excessive, requiring a 4 by 8 inch dressing which needed to be changed once to twice daily.

On September 20, the patient was transferred to St. Luke's Hospital for convalescence. It was thought that the drainage of bile-tinged fluid would stop spontaneously, unless there was a stone in the common duct. The patient got along well until October 27 when the drainage from the stab wound in the abdomen finally stopped. She had no drainage for a period of about five days after which pain began to develop in the right upper quadrant and epigastric region of the abdomen associated with a temperature of 101°F. orally. A large amount of thick bile-tinged material began to flow from the old Penrose drain site. On November 5 a considerable amount of tenderness developed in the epigastric region of the abdomen associated with a mass in this area which was quite tender to palpation. The white blood cell count rose to 24,250 per cu. mm. with 83 per cent polymorphonuclear leukocytes. A diagnosis of a subhepatic abscess was made.

The patient was returned to surgery on November 8 for a second operation. After the incision was extended down to the anterior rectus sheath in the area of the old Penrose drain site, a large amount of purulent-like bile-colored fluid was encountered. This extended under the skin from the mid-clavicular line to the mid-epigastric region. When the incision reached the peritoneal cavity much more of this material was encountered. It was found that the patient had an abscess measuring 7 cm. in diameter in the left lobe of the liver. There was also a bulky, soft yellow mass protruding from the abscess cavity which resembled an old sponge. It was removed and all excess fluid was aspirated. The gallbladder bed was normal; the common duct appeared to be normal in size and was not opened. A Penrose drain was inserted into the abscess cavity and the wound was closed in layers.

A report from the laboratory indicated that the material removed from the liver abscess was actually necrotic liver tissue. The postoperative course following this second procedure was uneventful and in about five days the patient was up and about. The drains were removed and the wound healed satisfactorily. She was ready for discharge ten days after the second surgical procedure. Since that time she has gotten along remarkably well, and has had no further drainage or abdominal complaints.

Comments: This case is very unusual, not only because an injury resulting in a subsequent slough of the liver was associated with a rupture of the gallbladder but also because the injury to the liver was unrecognized at the initial exploration. The fact that a portion of the left lobe of the liver became necrotic and sloughed suggests that the injury must have

been present initially, causing persistent drainage from the tract made by the Penrose drain. An unrecognized common duct stone could have also caused persistent drainage, although such drainage would probably not be viscid.

SUMMARY

Injuries to the biliary tract due to nonpenetrating abdominal trauma and the surgical therapy of these lesions are discussed. The majority of injuries to the gallbladder due to blunt trauma are associated with automobile accidents.

An unusual case of rupture of the gallbladder followed by a slough of a portion of the left lobe of the liver is presented.

If the patient's condition permits, cholecystectomy is the preferred form of surgical treatment in cases of traumatic rupture of the gallbladder.

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Hyperparathyroidism Suggested by a Primary Vesical Calculus

JAMES D. NIEBEL, M.D., *Monterey, California,* AND FORREST H. RIORDAN, III, M.D., *San Francisco, California*

From the Department of Surgery, Division of Urology, Stanford University School of Medicine, San Francisco, California.

IN the past few years, the diagnosis of hyperparathyroidism has been made with increasing frequency since it was demonstrated that the incidence of associated urinary tract calculi concomitant with this disease is very high. The world literature consists of over 700 proved cases of hyperparathyroidism with the diagnosis at present most frequently made following symptoms referable to calcification in the urinary tract, but more specifically in the kidney or ureter. Only a few cases of primary calcification in other parts of the urinary tract have been reported.

Albright et al. [1] listed a case of hyperparathyroidism which was diagnosed following detection of a calculus primary to the bladder and Bogdonoff et al. [2] reported a second case in their recent review. In the following case the sole symptom referable to hyperparathyroidism was a primary vesical calculus of rapid onset with no evidence of renal lithiasis or calcinosis. Only because of the policy of drawing a routine serum calcium and phosphorus was this case of hyperparathyroidism detected.

CASE REPORT

The patient was a seventy-one year old Negro man who entered San Francisco County Hospital for the first time on August 11, 1956, with hematuria. For ten years the patient had had progressive symptoms of obstruction of the lower urinary tract. One day prior to admission gross hematuria developed. There was no previous history of any hematuria, renal lithiasis or colic. The physical examination was essentially negative except for a firm, rubbery prostate, three times enlarged.

On intravenous pyelography August 12, 1956, a normally functioning upper urinary tract without calcification was seen. There was a large filling defect in the bladder, in the region of the prostate. Urinalysis disclosed a pH of 6.0, a specific gravity of 1.015, and a plus test for albumin. Uncentrifuged microscopic examination of the urine disclosed six to sixteen red blood cells and zero to four white blood cells, oxalate and phosphate crystals, and many bacilli and cocci.

On August 14, 1956, bilateral vasectomy and retropubic prostatectomy were performed. The prostate weighed 82 gm. and on microscopic examination consisted of nodular hyperplasia with inflammatory changes. The patient had an uneventful postoperative course and was discharged on August 24, 1956, to the follow-up clinic.

One month postoperatively a ventral hernia developed. The patient maintained a slight postoperative stress incontinence. In December 1956, he had occasional, mild, dull pain in the left flank and pyuria. An intravenous pyelogram was taken on December 12, 1956, and again, a normal upper urinary tract without calcification was demonstrated. A 2½ cm. calcific density was present in the lower bladder region, but was not diagnosed. The left ilium showed cortical thickening and sclerosis. The pain in the left flank disappeared during antimicrobial therapy.

In February 1957, he began to have occasional difficulty initiating urination, and frequently, voiding was cut off before the bladder was completely empty. Because of this symptom, cystoscopic examination was performed on March 4, 1957, and a calculus visualized in the prostatic fossa. It was easily dislodged into the bladder.

The patient was readmitted on March 7, 1957, for repair of a ventral hernia and cystolithotomy. On physical examination he had a lower midline ventral hernia, and slight tenderness in the area of the left kidney on palpation. The urinalysis taken at admission showed a pH of 6.0 and centrifuged sediment contained 40 to 60 white blood

cells per high power field and numerous bacilli. The blood urea nitrogen was 8 mg. per cent.

On March 12, 1957, a coarse, granular, 2½ cm., brownish-yellow calculus was removed via cystotomy and the ventral defect repaired. On March 23, a routine serum calcium was 12.6 mg. per cent and phosphorus was 2.9 mg. per cent. A repeat test on April 1 showed the serum calcium to be 13.2 mg. per cent and phosphorus was 2.9 mg. per cent. A three-day, 150 mg. low-calcium diet was prescribed, and on the fourth day the twenty-four hour urinary calcium excretion was 300 mg. and urinary phosphate was 511 mg. X-ray films of the hands, skull, chest and pelvis were negative for bone changes, other than the previously described sclerotic appearance in the left ilium.

Following discharge on April 6, 1957, the patient was readmitted for the third time on April 13, 1957, for a diagnostic hyperparathyroid work-up. He gave no history of symptoms referable to hyperparathyroidism such as bone pain, epigastric pain, constipation, polyuria, polydipsia, or renal colic. The physical as well as a slit lamp examination was negative for abnormalities. The Sulkowitch test on several urine specimens was 3 plus, the pH varied from 6.0 to 7.0, the specific gravity varied from 1.015 to 1.018, and the sediment contained scattered white blood cells and motile bacilli. Three serum calcium determinations varied from 12.7 to 12.9 mg. per cent, and the serum phosphorus from 2.6 to 2.9 mg. per cent. The total protein was 7.1 gm. per cent and the albumin/globulin ratio 4.3/2.8 gm. per cent; the alkaline phosphatase was 9.0 Bodansky units, the serum sodium was 136 mEq./L., carbon dioxide 26.4 mEq./L., and chloride 101 mEq./L. A twelve-hour TRP (tubular reabsorption of phosphate) on April 17, 1957, was 86 per cent, and on April 22, 1957, was 84.6 per cent (normal 78 to 90 per cent, mean 84.7 per cent plus or minus 0.9; hyperparathyroidism 41 to 82 per cent, mean 65.0 per cent plus or minus 1.3). Barium swallow was negative. Anterior cervical exploration of the neck was performed on April 23, 1957, and a markedly enlarged right lower parathyroid gland, 1.5 by 1 by 1 cm. was demonstrated. Further exploration disclosed no other abnormal parathyroid glands. The enlarged gland was removed without difficulty and on pathologic examination found to be a parathyroid adenoma.

The postoperative course was uneventful, without signs of tetany. The results of the urinary Sulkowitch test postoperatively decreased to 1 plus, and on April 29, the serum calcium was 9.6 mg. per cent and phosphorus 4.0 mg. per cent. On repeat examination on May 3, the serum calcium was 9.4 mg. per cent and the phosphorus 3.5 mg. per cent.

COMMENTS

Although hyperparathyroidism may cause primary calcification in any level of the urinary tract from the renal tubules down to the bladder (Norris [*18*]), a search of more than 700 reported cases of hyperparathyroidism in the world literature has yielded only two authenticated primary vesical calculi, representing the only clinical manifestation of hyperparathyroidism. The case described herein is reported not only to add the third primary vesical calculus to the literature, but more important to emphasize that this condition is usually overlooked when the etiology and treatment of otherwise routine vesical calculi are considered. It is perhaps not practical from an economic viewpoint to screen every case of vesical calculus in order to exclude the possibility of hyperparathyroidism. However, in those non-obstructed, otherwise urologically uncomplicated cases with vesical calculus or in those cases with known sudden onset of vesical calculus, the appropriate screening tests should be performed, namely serum calcium, phosphorus, and total protein. If there is any variation from normal in these values, then repeat studies followed by urinary calcium excretion rate and TRP studies would be necessary to exclude definitely a diagnosis of hyperparathyroidism.

Since this disease is curable surgically if the diagnosis is made early, before permanent renal damage has been effected, every attempt should be made to determine if hyperparathyroidism exists in the presence of the calcium-phosphate-oxalate groups of urinary tract calculi regardless of whether the calculus is present in the upper tract or in the bladder.

SUMMARY

A case of hyperparathyroidism is presented in which the diagnosis was made following the rapid onset of a primary vesical calculus. The diagnosis of hyperparathyroidism must always be considered when calculi are found anywhere in the urinary tract, notwithstanding the greater incidence in the kidney and ureter. Whenever such calculi are found serum calcium and phosphorus should be determined and if abnormal, more extensive biochemical procedures should be considered to establish the diagnosis definitely.

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Synovial Sarcoma Occurring in the Anterior Abdominal Wall

ROBERT MOSES, M.D., *Hialeah, Florida,* BERNHARD CHOMET, M.D., *Chicago Illinois,* AND MELVIN GIBBEL, M.D., *Chicago, Illinois*

From the Departments of Surgery, Veterans Administration West Side Hospital and the University of Illinois School of Medicine; and the Departments of Pathology, Veterans Administration West Side Hospital and Chicago Medical School, Chicago, Illinois.

SYNOVIAL sarcoma is a rare tumor which usually arises in the soft tissues of an extremity, generally near a joint, tendon sheath or bursa, and only rarely on the trunk. Three previous cases of synovial sarcoma arising in the abdominal wall have been reported in the literature [3,8]. We wish to report the fourth synovial sarcoma arising in the abdominal wall and to review briefly the natural history, localization and pathological features of this highly specialized and rare form of malignant tumor. For a more complete review of this tumor the reader is referred to the excellent papers by Bennett [2], Pack and Ariel [8], Haagensen and Stout [5], and Wright [11]. In 1927 Smith [9] first coined the term "synovioma" for these malignancies arising from synovial tissues. This nomenclature was generally accepted for many years, but since it did not indicate the truly malignant nature of the tumor the term synovial sarcoma has superseded it in most classifications. Other terms which have been used to describe and label this tumor are: adenosarcoma, villous angiofibroma, synovial sarcoendothelioma, synovial sarcomesothelioma, fibroendothelioma, sarcoma-fusoglobocellular, reticulohistiocytosarcoma, spindle cell sarcoma, cancerous synovial tumor and synovial endothelioma [2,8].

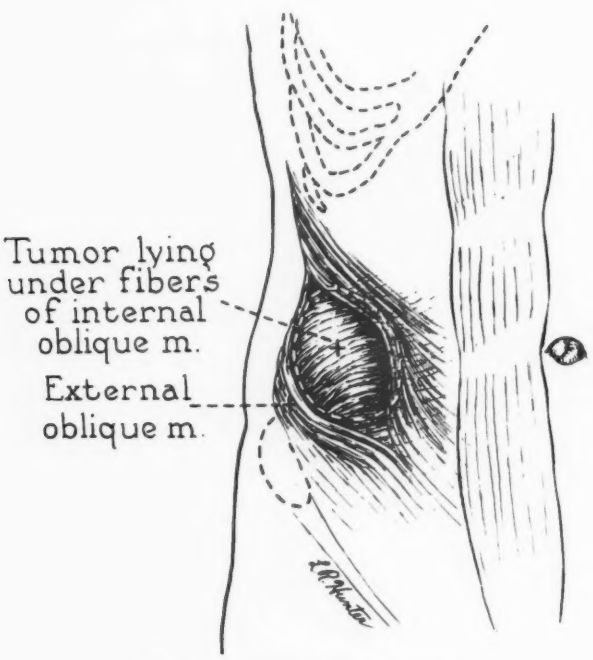

FIG. 1. Anatomical site of tumor.

CASE REPORT

This thirty year old white man entered the V. A. West Side Hospital on July 13, 1954, with the chief complaint of pain in the right testicle of four weeks' duration. The pain was of a dull, aching nature. There was no associated swelling of the testicle. He also noted some intermittent pain in the region of the right hip. The pain was not aggravated and did not radiate on coughing or sneezing. There were no complaints relative to the gastrointestinal system, cardiorespiratory system or the genitourinary system. The patient received shrapnel wounds of the right chest, right thigh and right iliac region in 1953 during the Italian campaign.

Physical examination revealed that the patient was a well developed, well nourished white man. Shrapnel scars were noted over the right side of the neck, right shoulder and right anterior chest. There were also shrapnel scars about the right upper thigh. None of the shrapnel scars were in the immediate area of the abdominal wall mass. There was a mass approximately 9 cm. in diameter in the right flank just superior to the crest of the right ileum and partially filling the space between

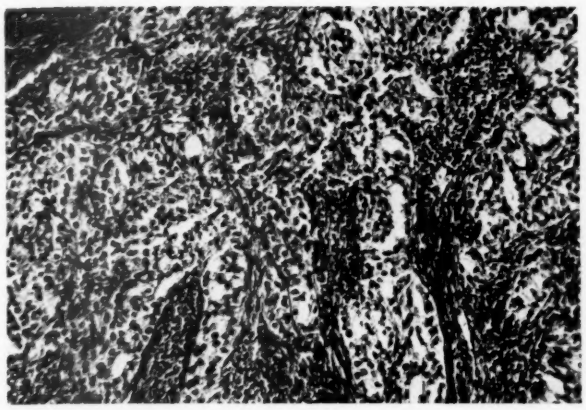

FIG. 2. Photomicrograph of primary tumor illustrating two characteristic features: (1) "glandlike" structures lined by cuboidal cells and (2) a fibrosarcomatous stroma.

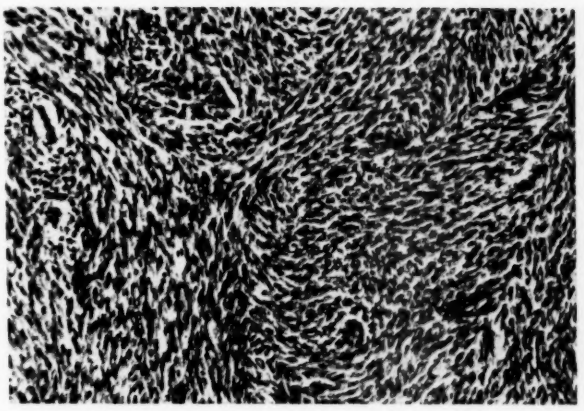

FIG. 3. Photomicrograph of recurrent tumor showing exclusively cellular fibrosarcoma.

the crest and the tip of the right eleventh rib. The mass was not tender, was slightly movable and seemed to be situated within the muscles of the abdominal wall. There were no palpable lymph nodes.

Laboratory studies revealed the following data: red blood cell count, 4.6 million per cu. mm.; hemoglobin, 14 gm. per cent; white blood cell count, 5,900 per cu. mm.; neutrophils, 63 per cent; lymphocytes, 22 per cent; monocytes, 11 per cent; eosinophils, 4 per cent. Urinalysis was within normal limits. Serologic test was negative. Intravenous pyelogram was within normal limits. X-ray of the chest revealed deformity of the fourth, fifth and sixth ribs on the right, secondary to shrapnel injuries. Barium enema revealed some displacement of the ascending colon toward the midline. The soft tissue mass was visible and was interpreted as being outside the lumen of the colon.

On July 28, 1954, exploration of the mass in the right flank was performed. The tumor mass was found to lie within the substance of the internal oblique muscle and between the external oblique muscle and the transversus abdominis muscle. The mass did not extend to the eleventh rib or to the crest of the right ilium. (Fig. 1.) The surgical procedure consisted of wide local excision which included the ventral fascia of the external oblique muscle, the major portion of the right internal oblique muscle and the greater portion of the right transversus abdominis muscle as well as adjacent properitoneal fat. The frozen section of the excised mass was reported as sarcoma. The patient's postoperative course was uneventful.

The pathologic report was as follows: A large mass was received that measured 10 cm. by 9 cm. by 6 cm. It was almost entirely enveloped by skeletal muscle with the exception of one area where it was covered by fascia. Cut surface of the mass showed yellow to yellowish grey tumor that was moderately firm and rather meaty in appearance. Gross suggestion of invasion of skeletal muscle was noted. Microscopic sections showed a very cellular neoplastic growth in which "glandlike structures" were found lying in a fibrosarcomatous-like stroma. The glandlike structures were lined by cuboidal cells. (Fig. 2.) The diagnosis was synovial sarcoma.

The patient was readmitted to the hospital on December 27, 1954, because of the presence of a small nodule, 2 cm. in diameter, in the right anterior abdominal wall near the costal margin. There was a second nodule approximately .5 cm. lateral to the previously described nodule. X-ray of the chest on this admission revealed no metastasis. Laboratory work-up was unchanged from the previous admission. On December 30 full-thickness excision of the remaining portion of the right abdominal wall lateral to the right rectus muscle was performed, preserving only the skin. This excision included all of the remaining muscle from the lateral edge of the right rectus abdominis muscle to the right quadratus lumborum muscle and from the costal margin to the iliac crest. The peritoneum was also included in this removal. At the time of surgery the two nodules were found to be in the remaining portion of the internal oblique muscle, 1 cm. below the costal margin. Repair consisted of a dermal graft from the left thigh to replace the abdominal wall defect. The patient's postoperative course was uneventful.

The pathologic report was as follows: A quadrangularly shaped mass was received, the outer surface of which showed skeletal muscle and fascia. Upon palpation two nodules were noted. These nodules measured 4 by 3 by 2.5 cm. and 1.5 by 2 by 2 cm. Cut surface of the nodules revealed yellowish grey, partly friable tissue with areas of hemorrhagic mottling. The tumor tissue appeared to be intimately attached to the fascia.

Microscopic examination showed invasion of skeletal muscle by a highly cellular fibrosar-

comatous lesion with an occasional cleft or tubular formation lined by cuboidal cells. A comparison with the original slides showed marked reduction of the glandlike structures. The diagnosis was recurrent synovial sarcoma.

Follow-up examination on March 4, 1955, revealed a nodular mass overlying the right eleventh rib. The patient was readmitted and the mass excised.

The pathologic report stated: A tumor mass was received that measured 7 by 6 by 3 cm. Its cut surface showed a spindle-shaped nodule which was grey and surrounded by skeletal muscle.

Microscopic examination showed a picture of highly cellular fibrosarcoma. No cleft or glandlike structures were noted. (Fig. 3.) The diagnosis was recurrent synovial sarcoma.

Later the patient was noted to have several large nodules developing in the lateral portion of the wound cicatrix. Chest x-ray at this time revealed no metastases. It was believed that further treatment should be palliative, and deep x-ray therapy was given to the right iliac region. Pulmonary metastases were first noted on a chest film taken on September 22, 1955. The patient's final course was complicated by severe pain in the right hip and the development of large tumor masses in the right iliac region. The pain was controlled with narcotics supplemented with thorazine® and cortisone. The patient died at home on October 29, 1955. Autopsy was refused.

CLINICAL FEATURES

Age and Sex Incidence. The tumor may appear at any age. The youngest patient reported was two weeks of age when the tumor was first noted and the oldest reported patient was seventy-five years of age [7]. Generally, it is a disease of the young adult, with a mean age of thirty-two years. The sex incidence is 3:2 with a predominance in males [5].

Localization. Almost all of these tumors arise in the extremities [1,4,6,8]. Less than 1 per cent arise outside of this locale. Seventy-nine per cent arise in the lower extremities and more than 50 per cent of these are in the vicinity of the knee joint [5,11]. Of the 21 per cent that arise in the upper extremities, almost 50 per cent occur in the region of the wrist and hand. Even though the cellular origin of synovial sarcoma is from the synovial membrane which lines joints, tendon sheaths or bursae, it is rare to see them growing within the joint space. Usually they seem to arise in the periarticular space and only invade the joint space late in their growth.

Symptomatology. The presenting complaint of the patient is most often pain. Frequently it is learned that there has been a slowly growing mass for several months or years and help has been sought only because it became painful. With the present emphasis on public awareness of cancer, together with increased emphasis on detection and recognition of early cancer, perhaps more tumors will be seen before the growth has produced pain. Often there is an antecedent history of trauma, but this would seem to be coincidental.

Metastasis. Synovial sarcoma, as contrasted to other sarcomas of the extremities, not infrequently metastasizes to the regional lymph nodes [4,6,8].

Differential Diagnosis. The diagnosis of this tumor preoperatively is practically impossible. The eventual diagnosis may be considered because of its location in the periarticular region of the knee or shoulder, but it is only established by microscopic examination. Often the final diagnosis is not considered preoperatively or at operation because of the long-standing history of the mass and because the gross pathology at surgery indicates a circumscribed tumor which seems to be encapsulated and which seems to "shell out" easily. These factors would emphasize the importance of adequate wide local excision of undetermined masses with subsequent microscopic examination.

PATHOLOGICAL FEATURES

Gross Pathology. These tumors are solid and usually appear well circumscribed. Occasionally they may have areas of calcification. The consistency of the tumor varies with the amount of stroma present. The color may vary from a pink to grey to a yellow-grey.

Microscopic Features. All synovial sarcomas have two cytological characteristics which are always present, even though the proportion of one to the other may be varied. One is a rich cellular stroma which is similar to a fibrosarcoma and the other is an epithelial-like element, probably arising from the synovial membrane, which forms peculiar clefts and glandlike structures interlined by cuboidal or columnar cells. Often, the cleftlike structures are only found on occasional sections, thus emphasizing the chance of error in diagnosis when random sections are taken, whether at

surgery, as a frozen section or from the excised complete specimen.

THERAPY

The results of treatment in synovial sarcoma have been very discouraging. This is especially so when a history is obtained of a tumor mass having been present for many years and following surgery, local recurrence and/or extensive general dissemination occurs. The mode of spread of synovial sarcoma has no fixed pattern and may be by fascial planes, venous channels or lymphatics. During the last decade a more radical surgical approach to these tumors has been adopted. The reported results of this approach leave much to be desired and there is doubt whether the five-year survival has been improved. We believe that wide local resection with the preservation of as much function as possible is desirable. This is only possible when the tumor is small, there are no metastases and/or the anatomical site is favorable. More often a major amputation is required. When regional node metastases are present or develop, they should be resected. At times palliation may be obtained with hemipelvectomy or forequarter amputation even though distant metastases exist. This is true when a large, ulcerating, painful mass is of such a nature that it is likely to ulcerate early in the patient's terminal course. These tumors are radioresistant and x-ray therapy would seem to have its chief application in palliation rather than cure of these tumors.

SUMMARY

1. A case report is given of a synovial sarcoma arising in the anterior abdominal wall. This is the fourth such case to be reported in the literature.

2. A brief review of the clinical and pathological features of synovial sarcoma is presented.

3. The treatment and poor prognosis of this very malignant tumor are discussed.

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Surgery Court Cases

HOWARD NEWCOMB MORSE,* *Chicago, Illinois*

SHEA VS. PHILLIPS

Supreme Court of Georgia

213 Ga. 269, 98 S. E. 552

This was a malpractice action by a patient's administratrix against a surgeon. The patient had filed the suit for damages against the surgeon but had died before it was tried and his administratrix was substituted in his stead as the party plaintiff. The Superior Court of DeKalb County, Georgia, dismissed the suit and the administratrix appealed.

The surgeon had performed two operations upon the patient. During the first operation about 6 inches of a plastic catheter had broken off in one of the patient's arteries. The second operation, which immediately followed the first one, was an unsuccessful effort to locate and remove the portion of the catheter adrift in the patient's arterial system.

The Court of Appeals of Georgia reversed the decision of the lower court and the surgeon appealed. The Court of Appeals held that the jury would have been authorized to find or infer from the evidence that the surgeon was negligent in failing to summon another surgeon to assist him before beginning the second operation on the patient.

The Supreme Court of Georgia reversed the decision of the Court of Appeals, in effect reinstating the decision of the trial court, holding the surgeon non-liable. The Supreme Court declared: " . . . this court will not hold that a jury is authorized to find that a competent surgeon is negligent in performing an operation until he calls some other surgeon to assist him." The Supreme Court went on to say that the surgeon " . . . in performing the two operations, exercised that degree of care, skill, and diligence which any competent surgeon would be required to employ in doing, as here, intricate and dangerous operations."

HART VS. FIELDEN

Court of Civil Appeals of Texas

295 S. W. 2d 911

This was an action by a patient against a surgeon for the loss of a finger alleged to have been caused by the surgeon's negligent treatment. The District Court of Gregg County, Texas, entered judgment on a verdict for the patient and overruled the surgeon's motion for a new trial, and the surgeon appealed.

The patient, while playing baseball, had sustained an injury to the distal joint of the index finger of her left hand. She went to the surgeon for treatment. The distal interphalangeal joint fracture was set by putting a wooden splint on the finger.

About four months later there was a distinct drooping of the distal phalanx and a bony spur formation in the back part of the joint and extending down into the joint which prevented the patient from straightening her finger or moving it with any degree of comfort.

After some discussion between the surgeon and the patient, surgery was performed to remove the bony spur. The operation was performed under a general anesthetic. After the

* Counsellor at Law, Member of the Bar of the Supreme Court of the United States of America.

operation the patient's finger became infected with a dry gangrene and the finger had to be amputated at the second or middle joint.

The jury found that the surgeon had failed to examine the finger of the patient, and that such failure was negligence and was a proximate cause of the loss of the patient's finger. The surgeon claimed that the patient wholly failed to show by any expert medical testimony that his failure to examine the patient's finger was the proximate cause of the loss of her finger. The surgeon contended that the uncontradicted testimony showed that examination by him could not have revealed the condition of the patient's finger in time to have remedied it.

The Court of Civil Appeals of Texas reversed the decision of the lower court. The Court of Civil Appeals stated: " . . . there is no evidence to show any causal connection between the failure of appellant [the surgeon] to examine appellee's [the patient's] finger and the dry gangrene which actually caused the loss of the finger. There is definitely no expert testimony that would show any direct connection . . . if [the surgeon] had examined the finger in the manner contended for by appellee, it was possible that dry gangrene could have been present and not detected; or, it could have been detected and at the same time have reached a point of no return."

The Diagnostic Corner

A CLINICAL and radiologic diagnostic exercise pertaining to an interesting type of acute surgical condition within the abdomen.

SIDNEY W. NELSON, M.D., *Columbus, Ohio*

From the Department of Radiology, The Ohio State University Health Center, Columbus, Ohio.

THIS eighty-four year old white woman was admitted to Mount Carmel Hospital in Columbus, Ohio, with the history of having had abdominal pain for the previous four days, during which time she had had no bowel movements. The patient was diabetic but was unable to state how much insulin she had been taking, and it was believed she had not been taking insulin for several months prior to admission. The patient was confused and it was difficult to evaluate the remainder of the history. Physical examination showed an elderly, emaciated female appearing acutely and chronically ill, and who was markedly dehydrated. The pulse rate was 100 and regular. There were no heart murmurs. Rales were heard in both lung bases. The abdomen was distended and tympanitic with tenderness in the right lower quadrant of the abdomen and a firm tender mass in the right upper quadrant, which was difficult to evaluate because of marked guarding and rigidity in this region. The bowel sounds were active. The blood sugar level was 299 mg. per cent and the carbon dioxide combining power was 53 per cent. The urine showed a trace of sugar and contained 20 mg. per cent of albumin. There was no acetonuria. White blood count was 16,650 per cu. mm. The red blood count was 3.4 million per cu. mm. with 10.4 gm. per cent of hemoglobin. The patient was taken to the radiology department where the foregoing supine film of the abdomen showed a very interesting and diagnostic radiologic finding indicating a specific type of acute surgical condition within the abdomen.

What is your diagnosis?

Please turn page for answer

DIAGNOSIS

Emphysematous cholecystitis. (Synonyms: Acute gaseous cholecystitis, pneumocholecystitis.)

In the supine abdominal film the gallbladder is almost completely outlined by the gas present in its wall (arrows). The x-ray is diagnostic of the condition.

The severe pain in the right upper abdominal quadrant of four days' duration associated with a right upper abdominal mass and polymorphonuclear leukocytosis in an elderly diabetic woman should place empyema of the gallbladder due to acute cholecystitis high on the list of diagnostic probabilities, although a partly obstructing perforated carcinoma of the hepatic flexure of the colon, carcinoma of the liver, etc., are other possibilities which would have to be considered on the basis of the physical findings alone. Emphysematous cholecystitis is a condition seen most frequently in elderly diabetic females with acute cholecystitis, which condition becomes complicated by the growth of anaerobic gas-forming bacilli in the wall of the gallbladder. In spite of vigorous treatment with antibiotics and chemotherapy this condition almost always proceeds to gangrene of the gallbladder, with resultant perforation and peritonitis, unless the gallbladder is surgically removed. The mortality rate is very high if surgery is delayed, because peritonitis in an elderly diabetic patient is often fulminating and fatal.

The patient was taken to surgery on the third hospital day following efforts to prepare her for cholecystectomy. The gallbladder was 7 inches in length and had ruptured to produce a localized abscess. The gallbladder was full of stones, and the wall of the organ was crepitant due to anaerobic interstitial infection. It was estimated that approximately 50 per cent of the wall was necrotic. The abscess was drained and the gallbladder was removed. Drains were placed in the right gutter and in the gallbladder bed, and brought out through a stab wound in the anterior portion of the abdomen. In spite of the vigorous antibiotic therapy, insulin and appropriate parenteral fluids, the patient died on the second postoperative day, presumably from peritonitis. Autopsy was not obtained, but smears of bile from the resected gallbladder showed many gram-positive bacilli.

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Book Reviews

The Year Book of General Surgery (1957–1958 Year Book Series). Edited by Michael E. DeBakey, B.S., M.D., M.S., Professor and Chairman of the Department of Surgery, Baylor University, Houston, Texas. The Year Book Publishers. Chicago, Ill. *Price* $7.50.

With the 1957–1958 edition Dr. DeBakey has assumed editorship of this distinguished annual volume of abstracts selected from the important current surgical literature. Dr. Evarts A. Graham, in thirty years as editor, had brought the Year Book to a high level of excellence. He had chosen a third of the articles to be included in this edition when death ended his illustrious career. The new editor is responsible for the remainder of the volume and for all the editorial comment.

The abstracts are representative, usually concise, always readable and informative. The crisp editorial comments achieve a sense of proportion and critical evaluation that adds value to the wealth of information presented, particularly in the cardiovascular sections. This volume is recommended for all who would like to find assembled in one place a brief but comprehensive view of one year's advances in general surgery.

DAN W. ELLIOTT, M.D.

A Review of the Ciba Foundation Colloquia on Endocrinology. Volume 11, entitled Hormones in Blood. Edited by G. E. W. Wolstenholme, O.B.E., M.A., M.B., B.CH. and Elaine C. P. Millar, A.H.-W.C., A.R.I.C. 416 pages, 74 illustrations. Little, Brown & Company. Boston, 1958. *Price* $9.00.

This volume presents the proceedings and discussions that took place from February 18–22, 1957, on hormones in blood. The participants were highly selected and limited in number. The caliber of the papers was of the highest order, but even more important were the discussions by the various participants at the end of each paper. They presented many of the difficulties and problems in the adaptation and interpretation of the technics that are usually ignored in most papers published in scientific journals. As a consequence, it is not only extremely informative but also quite helpful to anyone who intends to pursue any of the areas of investigation presented in this volume. The topic itself, hormones in blood, is one of the most pertinent to the concepts of modern endocrinology. By definition, a hormone is a substance produced in one organ of the body and carried by the circulating blood to another organ in which it evokes a response. Until relatively recently our efforts in measuring endocrine activity were predominantly achieved by measuring the metabolites of the various hormones that were excreted in the urine. This created many problems. The gap between formation, secretion, transport, storage, metabolism and excretion was a tremendous one. The application of the most modern chemical technics to this problem of identifying and quantitating the levels of various hormones in blood is truly a major advance in our endocrinology. I know of no other volume or symposium that has gathered together as much information in this particular area as has this volume. It is "must" reading for any person interested in any phase of this problem.

GEORGE HAMWI, M.D.

Aids to the Diagnosis and Treatment of Diseases of Children. By F. M. B. Allen, M.D., F.R.C.P. (Lond.) Bailliere, Tindall and Cox. London, 1957. *Price* $3.00.

This tidy volume is prepared primarily for the family physician and presents in well digested form selected information useful in a busy practice. Normal care, the common infections and a brief résumé of systematized disease entities are dealt with didactically and lucidly in the seventeen chapters and appendix of charts, tables and prescriptions. The contents include little that is new and much that some readers may consider outmoded, but throughout, mirrors the wisdom gained from experience by a practical clinician caring for little children.